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A FLORISTIC SURVEY OF THE BEAR TRAP CANYON, MADISON COUNTY, MONTANA, WITH A DISCUSSION OF AUTHOR CITATIONS USING THE CONNECTING WORDS IN OR EX

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ABSTRACT: The results of a floristic survey of the Bear Trap Canyon are presented in the form of an annotated checklist. Two hundred and forty-two taxa are listed representing 162 genera and 50 families. Habitat and distributional data are provided for each taxon. The checklist is prefaced by a discussion of the topography and major plant community types of the area. Problems concerning author citations using the connecting words in or ex, and the consequences of their incorrect usage, are discussed.

A floristic survey of the Bear Trap Canyon, Madison County, Montana, was conducted during the summer of 1979 while the author was employed by the Butte District Office, Bureau of Land Management, U.S.D.I. The study was made in order to determine the total vascular plant flora of the area, as well as to assess the occurrence, frequency, and distribution of actually or potentially threatened or endangered plant taxa, in compliance with the Endangered Species Act of 1973 (Public Law 93-205).

The Bear Trap Canyon, also known locally as the Madison Canyon, is located on the Madison River 13 km by air (17 km by road) NNE of Ennis, MT, in an area where the river cuts through the Precambrian bedrock of the Norris Hills (de la Montagne, 1960). Here the river flows rapidly to the north, dropping from an elevation of 1470 m at Ennis Lake to approximately 1420 m at the Missouri Flats located at the north end of the canyon. Throughout much of its nearly 16 km length this sharply incised, V-shaped canyon is in excess of 400 m deep. A small dam, associated with the Madison Powerhouse, is situated about 3.5 km N of the entrance to the canyon, and a primitive settlement has been established at the confluence of Bear Trap Creek and the Madison River. An undeveloped trail runs along the E bank of the river.

The vegetation differs drastically between the E and W sides of Bear Trap Canyon. In general, the eastern slope (W-facing) has large stands of rich, fairly mesic forest dominated by Pseudotsuga menziesii var. glauca, which often extend down to the shores of the Madison River. Individuals of Pinus contorta var. latifolia occur in drier areas. A large number of herbaceous taxa is found in these forests, including Osmorhiza chilensis, Arnica cordifolia var. cordifolia, Mertensia oblongifolia var. oblongifolia,

Smilacina racemosa, S. stellata, Dodecatheon pulchellum ssp. pulchellum, Actaea rubra, and Clematis occidentalis var. grosseserrata. Interspersed among these forested areas are fairly moist to dry, open grasslands and rocky slopes. Four permanent creeks occur on this side of the canyon, as well as a number of intermittent drainages.

By contrast, the western slope of the canyon is quite xeric, with dry, open grassland (often with scattered sagebrush), rocky slopes, and very little forested area. No continuously flowing creeks are found on this side of the canyon, and only a few draws have water in the spring.

A borad diversity of habitat types occurs in the canyon bottom itself. Many aquatic and semi-aquatic plants are found along the banks of the Madison River, including large, somewhat scattered populations of Carex nebraskensis, C. brevior, Scirpus microcarpus, Juncus balticus var. vallicola, and Ceratophyllum demersum. The rocky banks of the river provide mesic habitats for many species that appear unable to tolerate long periods of submergence. Fairly large stands of Prunus virginiana var. melanocarpa, Salix exigua, and Sambucus racemosa ssp. pubens occur along the banks of the river, particularly toward the N end of the canyon. Betula occidentalis and Cornus sericea ssp. occidentalis form dense thickets along the lower parts of the tributary creeks, and a number of herbaceous taxa are restricted to the cool, moist shade they provide. Some of these are: Heracleum lanatum, Mertensia ciliata var. ciliata, Carex athrostachya, C. sprengelii, Streptopus amplexifolius var. chalazatus, Circaea alpina, Ribes hudsonianum var. petiolare, Viola praemorsa, and Platanthera dilatata var. dilatata.

Fairly large, open, seasonally moist meadows occur on the alluvial fans of the larger tributary creeks where they flow into the Madison River. These meadows exhibit more floristic diversity than any other single habitat type in the canyon. Conspicuous members of these communities include Senecio serra var. serra, Symphoricarpos occidentalis, Carex spp., Geranium richardsonii, Agastache urticifolia var. urticifolia, Monarda fistulosa var. menthifolia, Elymus cinereus var. cinereus, Phleum pratense, Delphinium occidentale, and Physocarpus malvaceus.

Much drier meadows and grasslands, often with Artemisia tridentata, occupy other level areas and open slopes along the river. The vegetation here resembles very much that found on the open areas higher up the canyon walls. Commonly encountered taxa of these habitats include several species of Lomatium, Balsamorhiza sagittata, Gaillardia aristata, Lupinus arbustus ssp. calcaratus, L. burkei ssp. burkei, Oxytropis lagopus var. lagopus, Agropyron trachycaulum var. unilaterale, Bromus inermis var. purpurascens, Dodecatheon conjugens var. conjugens, and Delphinium bicolor.

Dry rock outcrops are fairly common in the canyon bottom, as well as on its western slopes. These sites support a sparse vegetation which includes taxa such as Woodsia oregana, Erigeron caespitosus, Stephanomeria tenuifolia var. tenuifolia, Arenaria capillaris ssp. americana, Sedum lanceolatum ssp. lanceolatum, Bouteloua gracilis, Bromus tectorum, Festuca idahoensis, and Collomia linearis.

A number of weedy and introduced plants are found around the Madison Powerhouse, the settlement at Bear Trap Creek, and along the road and parking area at the N end of the canyon. These include some species which have escaped from cultivation and have become established in more or less disturbed areas, primarily along the trail.

Only one plant taxon observed within the Bear Trap Canyon is of possible significance as a threatened species, Phlox albomarginata. This plant is known only from the mountains of western Montana and eastern Idaho (Hitchcock and Cronquist, 1973). Although P. albomarginata may be fairly common in certain areas, it was included on a list of plants with restricted distributions in Montana prepared by R. D. Dorn (pers. comm.). This taxon is in need of further detailed study to determine whether it should be considered as a threatened species.

Collections were identified using Hitchcock and Cronquist (1973), and nomenclature follows Kartesz and Kartesz (1980), with the following exceptions; Carex (Hermann, 1970), Juncus (Hermann, 1975), Sisyrinchium (Henderson, 1976), Aster (identified by A. G. Jones) and Lomatium (identified by M. A. Schlessman). Three additional references were consulted to verify certain identifications (Booth, 1972; Booth and Wright, 1966; Hitchcock et al., 1955-1969). Voucher specimens are deposited in MONT, with many duplicates in MONTU and ILL.

All author citations in which the connecting words in or ex are used have been verified and agree with Recommendations 46C and 46D, respectively, of the International Code of Botanical Nomenclature (Stafleu et al., Editors, 1978). Verification of these author citations was necessary as many of them are incorrectly given in Kartesz and Kartesz (1980), as well as elsewhere in the literature.

The distinctions between citations using in and ex are extremely important, and often not fully appreciated. Abbreviation of citations in which ex is used incorrectly in the place of in results in authorship being attributed to the person publishing the name, rather than to the person actually responsible for both naming and describing the new taxon. Conversely, abbreviation in situations where in has been used incorrectly attributes authorship to the person who supplies only the name, excluding citation of the authority who actually described it.

For example, there is considerable confusion concerning the author citation for names supplied by Nuttall and published by Torrey and Gray in their Flora of North America (1838-1843). According to Ewan, in the introduction to the facsimile version of Torrey and Gray's Flora (1969:iii): "Thomas Nuttall had agreed in 1837 to furnish Torrey and Gray with descriptions of hundreds of new species which he had discovered in his western travels. These would carry his name as author." Clearly the descriptions for these taxa were supplied by Nuttall and merely published by Torrey and Gray. The correct author citation for these names is "Nuttall in Torrey and Gray," in accordance with Rec. 46D of the Code. Should it become necessary or desirable, for editorial reasons, to abbreviate this citation, the Code states (p. 40): "The name of the author who supplied the description or diagnosis is the most important and should be retained..." This citation is simply abbreviated as "Nuttall."

However, many authors of floristic and monographic works have incorrectly cited the authority of these names as "Nuttall ex Torrey and Gray," with potentially undesirable consequences (e.g., Hitchcock et al., 1955-1969; Kartesz and Kartesz, 1980). Recommendation 46C of the Code states (p. 40): "When an author who first validly publishes a name ascribes it to another person, the correct author citation of the name is the actual publishing author, but the name of the other person, followed by the connecting word ex, may be inserted before the name of the publishing author, if desired." Abbreviation of the author citation "Nuttall ex Torrey and Gray" would result in the citation of "Torrey and Gray" as authors of all the names furnished them by Nuttall. Clearly this is incorrect, as well as being contrary to the intentions of Torrey and Gray.

Author citations using the connecting word ex are reserved for situations where only the name is supplied by one person, the description or diagnosis being prepared by the publishing author. This is not the case with Nuttall's names, as he supplied carefully prepared descriptions with his specimens, albeit sometimes modified by Torrey and Gray. Unfortunately, many botanists have been careless in their use of the word ex in author citations, frequently applying it in situations where the word in should be used. This error has resulted in incorrect abbreviation of author citations such that only the publishing author is cited, at the exclusion of the name of the person who named and described the new plant. Errors of this sort are by no means restricted to Nuttall's names published in Torrey and Gray's Flora. The contrary situation, in which in is used improperly, is less common.

In the following checklist the taxa have been arranged alphabetically to family, genus, and species under the following categories: Sphenophytina (horsetails), Filicophytina (ferns), Coniferophytina (conifers), Magnoliopsida (dicotyledons), and Liliopsida (monocotyledons). The following abbreviations are

used to designate the habitat(s), frequency, and area(s) in which each taxon occurs:

aq	aquatic	pf	Pseudotsuga forest
cb	canyon bottom	ra	rare
co	common	rb	river banks
da	disturbed areas	ro	rock outcrops
dg	dry grasslands	sb	stream banks
he	higher elevations	sg	sagebrush grasslands
lo	local	sm	seasonally moist meadows
me	middle elevations	sp	sparse
mm	moist meadows	we	weedy
of	open forests	ws	widespread
os	open slopes		

SPHENOPHYTINA (Horsetails)

EQUISETACEAE

Equisetum fluviatile L. — da, sm; sp; cb

Equisetum pratense Ehrh. — mm, rb; sp; cb

FILICOPHYTINA (Ferns)

ASPLENIACEAE

Athyrium filix-femina (L.) Roth — pf; sp; cb

POLYPODIACEAE

Woodsia oregana D.C. Eat. — ro; sp; cb, me

CONIFEROPHYTINA (Conifers)

CUPRESSACEAE

Juniperus scopulorum Sarg. — of, rb; sp; cb

PINACEAE

Pinus contorta Dougl.
var. latifolia Engelm. — of, pf; sp; me, he

Pinus flexilis James — of, pf; sp; he

Pseudotsuga menziesii (Mirbel) Franco
var. glauca (Beissn.) Franco — pf; co; ws

MAGNOLIOPSIDA (Dicotyledons)

ACERACEAE

Acer glabrum Torr.
var. douglasii (Hook.) Dippell — pf, of; cb, me

ANACARDIACEAE

Rhus trilobata Nutt. — os, sg; co, lo; cb

Toxicodendron radicans (L.) Kuntze — os, rb; lo; cb

APIACEAE

Cicuta douglasii (DC.) Coult. & Rose — rb; sp; cb

Cymopterus bipinnatus S. Wats. — os, sg; sp; me, he

Heracleum lanatum Michx. — sb; co, lo; cb

Lomatium ambiguum (Nutt.) Coult. & Rose — ro, os; sp; cb

Lomatium cous (S. Wats.) Coult. & Rose — os, sg; cb, me
Lomatium dissectum (Nutt. in Torr. & Gray) Math. & Const. var. eatonii (Coult. & Rose) Cronq. — ro, os; sp; cb
Lomatium foeniculaceum (Nutt.) Coult. & Rose var. macdougalii (Coult. & Rose) Cronq. — sg; sp; cb
Lomatium triternatum (Pursh) Coult. & Rose ssp. platycarpum (Torr.) Cronq. — ro; co; cb, me
Musineon divaricatum (Pursh) Nutt. in Torr. & Gray — os, sg; ra; cb
Osmorhiza chilensis Hook. & Arn. — pf, os, sb; cb, me
Osmorhiza depauperata Phil. — sb, pf; sp; me
Perideridia gairdneri (Hook. & Arn.) Math. ssp. borealis Chuang & Const. — sm; sp; cb
Sium suave Walt. — rb; sp; cb

APOCYNACEAE

Apocynum androsaemifolium L. ssp. pumilum (Gray) Boivin var. pumilum — os, rb; sp; cb

ASTERACEAE

Achillea millefolium L. var. lanulosa (Nutt.) Piper — sm, os; co, ws
Antennaria microphylla Rydb. — os, ro; co; ws
Arctium minus (Hill) Bernh. — da, pf; sp, lo; cb
Arnica cordifolia Hook. var. cordifolia — of, pf; co; ws
Artemisia ludoviciana Nutt. — os, sm; sp; ws
Artemisia tridentana Nutt. — sg; co; ws
Aster conspicuus Lindl. in Hook. — sm; sp; cb
Aster hesperius Gray — rb; sp; cb
Aster occidentalis (Nutt.) Torr. & Gray — sb; sp; cb
Balsamorhiza sagittata (Pursh) Nutt. — sg; sp, lo; cb
Brickellia grandiflora (Hook.) Nutt. — pf, ro; sp; cb
Carduus nutans L. — os; lo, we; cb
Centaurea maculosa Lam. — os; lo, we; cb
Cirsium arvense (L.) Scop. var. horridum Wimm. & Grab. — os; sp, we; cb
Cirsium undulatum (Nutt.) Spreng. — dg; sp; cb
Cirsium vulgare L. — os, sm; sp, we; cb
Crepis acuminata Nutt. ssp. acuminata — os, sg; sp; ws
Erigeron caespitosus Nutt. — ro, os; lo; cb
Erigeron formosissimus Greene — ro, os; sp; ws
Erigeron speciosus (Lindl.) DC. var. macranthus (Nutt.) Cronq. — mm, sm, pf; co; ws
Erigeron strigosus Muhl. var. strigosus — sg; sp, we; cb
Erigeron subtrinervis Rydb. var. conspicuus (Rydb.) Cronq. — sm; sp; cb
Euthamia graminifolia (L.) Cass. var. major (Michx.) Moldenke — rb; sp; cb
Gaillardia aristata Pursh — os, sm; co; ws
Grindelia squarrosa (Pursh) Dunal var. quasiperennis Lunell — dg, sg; co; ws

Helenium autumnale L.
var. montanum (Nutt.) Fern. rb; sp; cb
Heterotheca villosa (Pursh) Shinners
var. hispida (Hook.) Harms os, sm; sp; cb
Hieracium cynoglossoides Arv.-Touv. os, pf; sp; cb
Lactuca serriola L. rb; sp, we; cb
Lactuca tatarica (L.) C.A. Mey.
ssp. pulchella (Pursh) Stebbins pf, of; co; cb
Leucanthemum vulgare Lam. os, da; sp; cb
Liatris punctata Hook. sg, os; sp; cb
Rudbeckia laciniata L.
var. ampla (A. Nels.) Cronq. mm; sp; cb
Rudbeckia occidentalis Nutt.
var. occidentalis mm; sp; cb
Senecio canus Hook. os, ro; ra; me
Senecio hydrophilus Nutt. rb; sp; cb
Senecio integerrimus Nutt.
var. exaltatus (Nutt.) Cronq. sm, os; sp; cb
Senecio serra Hook. var. serra sm, mm; co; ws
Solidago missouriensis Nutt.
var. fasciculata Holz. sb, sm; sp; cb
Solidago multiradiata Ait.
var. scopulorum Gray pf; co; cb, me
Sonchus arvensis L.
ssp. uliginosus (Bieb.) Nyman rb; sp; cb
Sonchus oleraceus L. rb; sp, lo; cb
Stephanomeria tenuifolia (Torr.) Hall
var. tenuifolia os, ro; co; ws
Tanacetum vulgare L. os, ro; lo, we; cb
Tragopogon dubius Scop. sm, sg; co; cb, me

BETULACEAE
Betula occidentalis Hook. sb; co; cb, me

BORAGINACEAE
Cynoglossum officinale L. sm, os; sp, we; cb
Hackelia deflexa (Wahlenb.) Opiz var.
americana (Gray) Fern. & I.M. Johnst. pf, ro; sp; cb
Hackelia micrantha (Eastw.) J.L. Gentry sm, os; co, lo; cb
Hackelia patens (Nutt.) I.M. Johnst.
var. patens os; sp, lo; me
Lithospermum incisum Lehm. sm; sp; cb
Lithospermum ruderale Dougl. in Lehm. sg; sp; cb
Mertensia ciliata (Torr.) G. Don
var. ciliata sb; co; cb, me
Mertensia oblongifolia (Nutt.) G. Don
var. oblongifolia pf; co; cb, me

BRASSICACEAE
Arabis sparsiflora Nutt. in Torr. & Gray
var. subvillosa (S. Wats.) Rollins of; ra; me
Berteroa incana (L.) DC. dg, sg; sp; cb

Camelina microcarpa Andrz. ex DC. sg; sp; cb
Cardamine breweri S. Wats. var. breweri sb; ra, lo; cb
Descurainia richardsonii (Sweet) O.E. Schulz ssp. viscosa (Rydb.) Detling sm, mm, of; co; cb
Draba nemorosa L. mm; sp; cb
Erucastrum gallicum (Willd.) O.E. Schulz sm, da; sp, we; cb
Erysimum inconspicuum (S. Wats.) MacM. sg; sp; cb
Lepidium densiflorum Schrad. var. macrocarpum Mulligan sg, dg; sp; cb, me
Lepidium virginicum L. var. pubescens (Greene) C.L. Hitchc. sg; co, lo, we; cb
Rorippa palustris (L.) Bess. ssp. hispida (Desv.) Jonsell var. hispida (Desv.) Rydb. rb; sp; cb
Sisymbrium altissimum L. dg, sg, os; sp; ws

CACTACEAE
Opuntia polyacantha Haw. ro, sg; sp; cb

CAMPANULACEAE
Campanula rotundifolia L. os, dg; co; cb

CAPRIFOLIACEAE
Sambucus racemosa L. ssp. pubens (Michx.) House rb, os; co; cb
Symphoricarpos occidentalis Hook. mm, sm, pf; co; ws

CARYOPHYLLACEAE
Arenaria capillaris Poir. ssp. americana Maguire os, dg; co; ws
Cerastium arvense L. os, ro; sp; ws
Cerastium fontanum Baumg. ssp. triviale (Link) Jalas sb, os; sp; cb
Silene alba (P. Mill.) Krause sg, dg; sp; cb

CERATOPHYLLACEAE
Ceratophyllum demersum L. aq, rb; co, lo; cb

CORNACEAE
Cornus sericea L. ssp. occidentalis (Torr. & Gray) Fosberg sb; co, lo; cb

CRASSULACEAE
Sedum lanceolatum Torr. ssp. lanceolatum ro, os; co; ws

FABACEAE
Astragalus canadensis L. var. brevidens (Gandog.) Barneby sm, os; sp; cb
Astragalus crassicarpus Nutt. var. paysonii (E.H. Kelso) Barneby os, sg; co; cb, me
Astragalus lentiginosus Dougl. in Hook. var. platyphyllidius (Rydb.) M.E.Peck os, ro; sp; cb

Glycyrrhiza lepidota Pursh var. glutinosa (Nutt. in Torr. & Gray) S. Wats. — rb; sp; cb
Lupinus arbustus Dougl. ex Lindl. ssp. calcaratus (Kellogg) D. Dunn — sg, os; co; me, he
Lupinus burkei S. Wats. ssp. burkei — sm, os; sp; cb
Lupinus sericeus Pursh var. sericeus — sm, os; sp; cb, me
Medicago lupulina L. — sm, os; sp; cb
Medicago sativa L. — rb; sp; cb
Melilotus alba Medic. — sm, os; sp, we; cb
Melilotus officinalis (L.) Pallas — sm, os; sp, we; cb
Oxytropis lagopus Nutt. var. lagopus — sg; co, lo; cb
Oxytropis sericea Nutt. in Torr. & Gray var. sericea — os, ro; sp; cb
Thermopsis montana Nutt. in Torr. & Gray var. montana — mm; sp; cb
Trifolium longipes Nutt. in Torr. & Gray ssp. reflexum (A. Nels.) Gillett — mm; co; cb, me
Vicia americana Muhl. in Willd. ssp. americana — os, ro; sp; cb

GERANIACEAE

Geranium richardsonii Fisch. & Trautv. — sb; co, lo; cb, me
Geranium viscosissimum Fisch. & Mey. var. viscosissimum — pf; sp; cb, me

GROSSULARIACEAE

Ribes aureum Pursh var. aureum — os, sm; co; ws
Ribes inebrians Lindl. — os, sm; co; ws
Ribes hudsonianum Richards. var. petiolare (Dougl.) Jancz. — sb; sp, lo; cb, me
Ribes setosum Lindl. — os, sm; sp; cb

HYDRANGEACEAE

Philadelphus lewisii Pursh — sm, os; co; ws

HYDROPHYLLACEAE

Hydrophyllum capitatum Dougl. in Benth. var. capitatum — os; sp; me
Phacelia hastata Dougl. in Lehm. ssp. hastata — os; co; ws
Phacelia linearis (Pursh) Holz. — os, ro; sp; me

LAMIACEAE

Agastache urticifolia (Benth.) Kuntze var. urticifolia — sm, os; co; ws
Lycopus asper Greene — rb; sp; cb
Mentha arvensis L. ssp. haplocalyx Briq. — rb; co, lo; cb
Monadra fistulosa L. var. menthifolia (Graham) Fern. — sm, rb; co, lo; cb
Nepeta cataria L. — os, da; sp; cb
Prunella vulgaris L. — mm; sp; cb
Scutellaria galericulata L. — rb; ra; cb

MALVACEAE
Alcea rosea L. sm; co, lo, we; cb
Iliamna rivularis (Dougl. in Hook.) Greene
var. rivularis sm; ra; cb

ONAGRACEAE
Circaea alpina L. sb; co, lo; cb, me
Epilobium angustifolium L. mm; co, lo; cb
Epilobium minutum Lindl. ex Hook. sg; co; ws
Gaura coccinea Pursh sg; sp; cb

PLANTAGINACEAE
Plantago major L. var. major sm, os; sp, we; cb

POLEMONIACEAE
Collomia linearis Nutt. os, ro; co, lo; me
Gilia tenerrima Gray os, ro; sp; ws
Phlox albomarginata M.E. Jones sg; ra; cb

POLYGONACEAE
Eriogonum umbellatum Torr. var. majus Hook. sm, os; co; ws
Polygonum lapathifolium L. rb; sp; cb
Rumex crispus L. sb, mm, sm; co, we; ws
Rumex triangulivalvis (Danser) Rech. f.
var. triangulivalvis os; sp; cb

PORTULACACEAE
Claytonia perfoliata Donn pf, mm; co; ws
Lewisia rediviva Pursh sg, dg; sp; me, he

PRIMULACEAE
Dodecatheon conjugens Greene
var. conjugens pf, sm, os, sg; co; ws
Dodecatheon pulchellum (Raf.) Merr.
ssp. pulchellum sm, os; co; ws
Lysimachia ciliata L. rb; co, lo; cb
Lysimachia thyrsiflora L. rb; ra; cb

RANUNCULACEAE
Actaea rubra (Ait.) Willd. pf, of; co; ws
Aquilegia flavescens S. Wats. pf, sm, os; sp; ws
Clematis occidentalis (Hornem.) DC.
var. grosseserrata (Rydb.) J. Pringle pf, of, os; sp; ws
Clematis lingusticifolia Nutt.
in Torr. & Gray sm, os; co, lo; cb
Delphinium bicolor Nutt. & Wyeth os, ro; co; ws
Delphinium occidentale (S. Wats.) S. Wats.
ssp. occidentale sm; co, lo; cb
Ranunculus abortivus L. rb; sp; cb
Ranunculus acriformis Gray
var. montanensis (Rydb.) L. Benson sb; sp; cb
Ranunculus macounii Britt. rb; co, lo; cb

Ranunculus uncinatus D. Don in G. Don var. uncinatus	sb; ra; cb, me
Thalictrum dasycarpum Fisch. & Lall.	rb; sp; cb
Thalictrum venulosum Trel.	sm, os; sp; cb
ROSACEAE	
Amelanchier alnifolia (Nutt.) Nutt. var. alnifolia	sb, sm; sp; cb
Fragaria vesca L. ssp. bracteata (Heller) Staudt	mm, pf; sp; cb, me
Geum triflorum Pursh var. triflorum	sm, os, sg; sp; ws
Physocarpus malvaceus (Greene) A. Nels.	sm, os; sp; ws
Potentilla anserina L.	rb; ra; cb
Potentilla arguta Pursh	os, ro; sp; cb
Potentilla biennis Greene	sb; sp; cb, me
Potentilla gracilis Dougl. ex Hook. var. flabelliformis (Lehm.) Nutt. in Torr. & Gray	sm; sp; cb
Potentilla pensylvanica L.	sm, os; sp; cb
Prunus virginiana L. var. melanocarpa (A. Nels.) Sarg.	rb, sm; co, lo; cb
Rosa woodsii Lindl. var. ultramontana (S. Wats.) Jepson	sm, os; co; ws
Rubus idaeus L. ssp. sachalinensis (Levl.) Focke	sm, os; co; ws
Rubus parviflorus Nutt.	pf, sm, sb; sp; ws
Spiraea betulifolia Pallas ssp. lucida (Dougl. ex Greene) Taylor & MacBryde	sm, of; sp; ws
RUBIACEAE	
Galium aparine L.	rb, sb; sp; ws
Galium boreale L.	sm, of, os; sp; ws
Galium tricornutum Dandy	sm, os, sb; sp; ws
SALICACEAE	
Salix exigua Nutt.	sm, rb; co, lo; cb
SANTALACEAE	
Comandra umbellata (L.) Nutt. ssp. pallida (A. DC.) Piehl	sg; co, lo; ws
SAXIFRAGACEAE	
Conimitella williamsii (D.C. Eaton) Rydb.	sm; sp; cb, me
Heuchera cylindrica Dougl. in Hook. var. cylindrica	mm; sp, lo; cb
Heuchera flabellifolia Rydb. var. flabellifolia	mm; so, lo; cb
Lithophragma parviflora (Hook.) Nutt. in Torr. & Gray	os, sm, sb; sp; ws

SCROPHULARIACEAE

Castilleja hispida Benth. in Hook.
ssp. acuta Pennell — sm, os; sp; me
Castilleja miniata Dougl. ex Benth. in Hook.
var. miniata — sm, pf; sp; cb
Castilleja pallescens (Nutt. ex Gray) Greenm. — sg, dg; sp; ws
Linaria genistifolia (L.) P. Mill.
ssp. dalmatica (L.) Marie & Petitmengin — os, da; sp; cb
Penstemon attenuatus Dougl. ex Lindl.
var. pseudoprocerus (Rydb.) Cronq. — sm, os; sp; me
Penstemon nitidus Dougl. ex Benth.
var. nitidus — os, dg; sp; cb
Verbascum thapsus L. — da, os; co, we; cb
Veronica serpyllifolia L.
ssp. humifusa (Dickson) Syme — rb; ra; cb

SOLANACEAE

Solanum dulcamara L. — da, rb; sp, we; cb

URTICACEAE

Urtica dioica L. ssp. gracilis (Ait.) Seland.
var. lyallii (S. Wats.) C.L. Hitchc. — sm, sb; sp; cb, me

VERBENACEAE

Verbena bracteata Lag. & Rodr. — os, da; sp; cb

VIOLACEAE

Viola canadensis L.
var. corymbosa Nutt. in Torr. & Gray — pf, sb; co; ws
Viola praemorsa Dougl. ex Lindl. — sb; ra; cb

LILIOPSIDA (Monocotyledons)

CYPERACEAE

Carex athrostachya Olney — sb; sp, lo; me
Carex brevior (Dewey) Mack. — rb; co, lo; cb
Carex douglasii Boott — sm, mm; sp; cb
Carex foenea Willd. — sm, os; sp; cb
Carex lanuginosa Michx. — rb; co, lo; cb
Carex nebraskensis Dewey — rb; co, lo; cb
Carex petesata Dewey — os; sp, lo; me
Carex praticola Rydb. — os; ra; me
Carex sprengelii Dewey — sb; sp, lo; cb
Carex vernaculata Bailey — sm; sp; cb
Eleocharis palustris (L.) Roemer & Schultes — rb; co, lo; cb
Scirpus microcarpus Presl — rb; co, lo; cb

IRIDACEAE

Iris missouriensis Nutt. — sm; sp, lo; cb
Sisyrinchium idahoense Bickn.
var. occidentale (Bickn.) Henderson — sm, os; ra; me

JUNCACEAE

Juncus balticus Willd. var. vallicola Rydb.	rb; co, lo; cb
Juncus filiformis L.	mm, os; sp; cb

LILIACEAE

Allium cernuum Roth	sm, ro; co, lo; cb
Allium textile A. Nels. & J. F. Macbr.	ro, os; sp; cb
Fritillaria atropurpurea Nutt.	mm; co, lo; cb
Smilacina racemosa (L.) Desf.	pf, of; sp; ws
Smilacina stellata (L.) Desf.	sb, pf; co; ws
Streptopus amplexifolius (L.) DC. var. chalazatus Fassett	sb; co, lo; cb, me
Zigadenus venenosus S. Wats. var. gramineus (Rydb.) Walsh	sm, os; sp; ws

ORCHIDACEAE

Platanthera dilatata (Pursh) Lindl. var. dilatata	sb; sp; cb, me

POACEAE

Agropyron trachycaulum (Link) Malte var. trachycaulum	sg, dg; co, lo; ws
Agrostis stolonifera L. var. stolonifera	rb; sp; cb
Agrostis thurberiana A.S. Hitchc.	pf; sp; cb, me
Bouteloua gracilis (H.B.K.) Lag.	sg, dg, os; co; ws
Bromus anomalus Rupr.	pf, of; co; ws
Bromus inermis Leyss. ssp. pumpellianus (Scribn.) Wagnon var. pumpellianus (Scribn.) Wagnon	os; sp, lo; ws
Bromus tectorum L.	os; sp, lo; ws
Calamagrostis canadensis (Michx.) Beauv. var. canadensis	mm, sm; sp; cb
Dactylis glomerata L.	rb, sb, sm; sp; cb
Elymus cinereus Scribn. & Merr. var. cinereus	sm; co, lo; ws
Festuca idahoensis Elmer	sg, dg; co, lo; ws
Phleum pratense L.	sm, os; co; ws
Poa nervosa (Hook.) Vasey var. wheeleri (Vasey) C.L. Hitchc.	sm, os; sp; ws
Poa palustris L.	rb; sp, we; cb
Poa pratensis L.	sm; sp; ws

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PAST AND PRESENT OAKS OF TURKEY. PART I*

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Dedicated to the foresters of Turkey.

A B S T R A C T

The 450 spp. of Quercus are restricted to diverse environments of the northern hemisphere. One of the ancient angiosperm genera, it was abundant during the Cretaceous associated with spp. of Magnoliaceae and Lauraceae. Tentatively, eighteen fossil taxa are recognized, mostly from the upper Miocene diatomite sediments along the Gürcü Valley some 90 miles north of Ankara. From western Anatolia, additional leaf remains were collected from open strip mines of lignite. Most coriaceous leaf impressions are of evergreen taxa with affinities to extant Caucasian, Himalayan and east asiatic spp. Presently Quercus is represented by 20 spp. in Turkey, most of which are deciduous trees of economic importance. Distributional maps indicate the geographical extent of these spp. Q.troyana and Q.pontica are very rare Tertiary relic spp. which merit protection from danger of extinction. Interspecific hybridization is common; 31 hybrids have been recognized. No attempt has been made to describe the hybrids of the fossil spp. although the magnitude of foliar and cupular variation suggests a high degree of hybridization.

My interest in the genus Quercus started in 1937 when I was a student of Kurt Krause, one of the collabor-

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ators of Adolf Engler. Amentiferae, so-called primitive angiosperms, were exemplified by the oaks and oak allies under the order Fagales. Since then, I have been collecting oaks during my botanical excursions as well as during my leisure trips in Turkey and elsewhere. My collections grew bigger and bigger and tempted me to study them for my doctoral dissertation at the University of California, Berkeley. Unfortunately, my specimens were shipped to a wrong address and it took me many years to locate them. Meanwhile as students of Herbert Mason at U.C. Berkeley, we questioned the primitive status of Amentiferae with simple flowers versus the complex flowers of the Ranalian groups. Most of us inclined to believe that the simplicity of the Amentiferae resulted from a series of abortions of the floral appendages and therefore, Amentiferae could not be primitive. In fact, we were pleased to note that the heterogenous group of Amentiferae occupied advanced levels in the monophyletic system of Charles Bessey. I postponed my studies of oaks and studied some of the members of Lauraceae instead.

Many years later, I discovered quite incidentally the Tertiary fossil beds of Gürcü Valley near Güven Village some 90 kilometers north of Ankara during a picnic outing. During my first excavations in 1968, I collected 125 specimens of impressions, mostly belonging to the oaks, maples, chestnuts, elms and Zelkova, Magnolias and Mahonias. Among these broad-leaved trees, Quercus was the most common element, represented by leaves, catkins, and cupule impressions. Glyptostrobus, Sequoia, Taxodium and five species of pines were the most common species of gymnosperms. When I showed the collections to the late Professor Ralph Chaney, he was most impressed with the redwoods, of couse, since they had never been reported from Asia Minor. Dr. Chaney identified the age of the Güven deposits as Upper Miocene while several other colleagues in Paleobotany and Geology suggested the Pliocene epoch. With the support of the National Science Foundation, I made three additional visits to the Gürcü (Georgian) Valley and with the collaboration of Daniel Axelrod and the paleontologists of the Mineral Research and Exploration Institute of Turkey (M.T.A.), we collected more than a thousand specimens in 1975, 1976 and 1978. The duplicate or counterpart specimens were deposited at the Turkish Museum of Natural History M.T.A. in Ankara, but all the plant and animal impressions were loaned to me for identification. With the assistance of Professor Axelrod, we also selected rock samples of andesite, rhyolite and welded tuffs for absolute age determination through K/Ar isotopes in biotites contained in these rocks. The age of the fossil deposits in Gürcü Valley was 14.1 $\pm$ 1 million years, corresponding

to the Upper Miocene. This ancient coniferous forest, rich in Arcto-Tertiary elements, occupied a mesophytic environment around a large fresh-water lake as evidenced by the abundance of frustules of pennate fresh-water diatoms, Cyprinid fish fossils, frogs, salamanders, mosquito larvae, Nematoceran flies, dragon flies, bees and beetles as well as by aquatic plants such as Salvinia, Egregia, cattails,etc.. Apparently, repeated volcanic activities took place around this fresh-water lake pouring lava and hot volcanic ash into the lake which I believe was a remnant of the Sea of Paratethys which consisted of brackish water. The rapid sedimentation of diatomaceous frustules associated with volcanic ash and the accumulation of fine silt through the streamsflowing into the lake formed the laminated diatomites and paper shales which contain the fossil impressions. Unfortunately, most of the organic matter was decomposed and I had no compressions to study the foliar cuticles. From the sediments, we extracted a great variety of pollen grains, most of which belong to Quercus spp.. However the morphology of the pollen grains under the resolving power of the light microscope was not a useful tool for the species distinction. On the other hand, the foliar venations of the oaks were well preserved including the minor venations in many specimens. The extant species of the oaks of Turkey were the main tools of comparison with those of the Miocene oaks. With the generous help of the Turkish Forestry Service, I built up a sizable collection of the living oaks. Serveral leaves from each of the twenty living species were cleared in sodium hydroxide and Chloral hydrate solutions. After having been stained with safranin, these cleared leaves were mounted permanently in large-size glass plates. For the description of the foliar vasculations, I followed the standardized terminology outlined by Hickey and Dilcher. Some Miocene oaks of Turkey exhibit strong affinities to North American and Far Eastern taxa as I will point out in this paper. The cleared leaves of the American and Asian oaks were borrowed from the U.S. Geological Survey in Menlo Park through the courtesy of Jack Wolfe and from the slide collections of the U.C. Paleontology Department in Berkeley through the courtesies of Wayne Fry and Howard Schorn. The Miocene oaks of Turkey display an enormous variation with respect to the foliar, floral and cupular structures. Obviously, the Tertiary oaks exhibited an enormous amount of interspecific hybridization and introgression as is characteristic of the extant species of oaks. Although I could recognize the possible hybrid oaks among the extant species, it was impossible to make such an attempt for the Miocene oaks since not a single specimen was collected with leaves, buds, catkins, or fruits

attached to a branch.

As we know now, the oaks are not as recent as we thought. Quercus, Quercophyllum and Dryophyllum were reported from the Early Cretaceous of the northern hemisphere. Approximately 135 million years ago, the oaks were widely distributed together with the several members of Magnoliaceae and Lauraceae. Unfortunately, we have no information concerning their occurrence in Asia Minor during the Cretaceous period. During Oligocene and Miocene, the oaks were widely distributed together with Tertiary relics such as Metasequoia and Cercidiphyllum. Some Cretaceous and Early Tertiary oaks were confused with the genus Fagus since the foliar remains resemble each other. Quercus miopontica reported in this paper is very similar to Q.pontica native to the mountains of N.E.Turkey and Abkhasia in Caucasus. Q.pontica in the high elevations of the Caucasian range (1400-2000 m.) and Q.sadleriana in northern California and southern Oregon (1300-2300m.) represent the most primitive taxa of the genus as pointed out earlier by Schwarz. In spite of a disjunct distribution, these two living taxa are very similar with regard to their habits, vegetative and reproductive structures, foliar venation and their epidermal ultrastructure; hence they deserve to be reduced to a single taxon.

I am very grateful indeed to my colleague Hicri Aksoy, former Undersecretary of the Turkish Ministry of Agriculture who collected excellent specimens of fossil oaks from the Güven locality and Gerçek Saraç, a paleontologist of the Mineral Research and Exploration Institute (M.T.S.) of Turkey for accompanying and helping me a great deal during my expeditions to Güven of Ankara and to the open lignite mines of western Anatolia.

I particularly wish to thank my colleague Ismail Karakan, former Chief of Turkish Forestry Service who provided a large collection of herbarium specimens of oaks collected from Turkey. These specimens will be deposited in the herbaria of the University of California, Davis and California Academy of Sciences in San Francisco upon the completion of this work. Since the Turkish Forestry Service in Ankara has a complete set of these collections, the surplus specimens will be distributed to the herbaria and other institutions or individuals upon the priorities of the written requests I receive. I would like to thank Dr. Robert Ornduff, Director of the Univ. Herbarium in Berkeley, Dr. Daniel Axelrod and Dr. John Tucker (Botany Dept., U.C.Davis), the staff members of the Botany Dept. of the California Academy of Sciences and the curators of the Paleobotanical collections at the Paleontology Dept. of U.C.Berkeley who kindly allowed me to use their collections and libraries for comparison and identification

of my specimens. The hand drawings were prepared by Anne Crocker, Elizabeth Fall, Anne Jones, Shannon Parr, Lee Ann Tegart and Angela van Patten, all former students of Mills College. Credit is given to every artist in the legends of the illustrations. The photographs of the fossil specimens and cleared leaves were taken by David Kasaplıgil with the assistance of Howard Schorn, by Margret Mukai and Robin Rickensrud. The microslides of the cleared leaves were prepared by Joan Amorogo, Margret Mukai and Ellora Ong. Several other students of mine such as Elizabeth Fall, Sylvia Hsi, Sue Kirkbride, Keli Ryan and Elizabeth Varnhagen were most helpful in preparing the specimens for this study and classifying the research material. My humble role in the course of this work was being the conductor of an orchestral team and assuming all responsibilities regarding the factual and speculative statements.

For the sake of convenience and simplicity, partly due to my own ignorance, the taxa included in this study are arranged alphabetically covering the extant and fossil species as well as the hybrid oaks of Turkey. However, the classical systems of classifications proposed by Camus and Schwarz are presented synoptically.

Last but not least, I would like to thank my friends Lita Clapper and Sylvia Hsi for a difficult task of typing the manuscript and Dr. Rimo Bacigalupi (Curator Emeritus of the Jepson Herbarium, U.C. Berkeley) for reading this introduction.

A KEY FOR THE IDENTIFICATION OF THE EXTANT SPECIES OF GENUS QUERCUS IN TURKEY

1.Acorns ripening within the first year
  2.Leaves are deciduous
    3.Leaf margins lobate
      4.Petiole is grooved and twigs are glabrous
        5.Peduncle long, usually longer than petiole
          6.Blades with 9-12 pairs of lobes 1/6 to 1/10 the breadth of the blade; no intercalary veins; petiole 10-20mm. 1.Q.hartwissiana
          6.Blades with four to six pairs of lobes 1/3 to 1/5 the breadth of the blade; has intercalary veins; petiole 5-7mm. .2.Q.robur
        5.Peduncle short or absent
          7.Scales of cupule are pubescent and not tuberculate; intercalary veins are not present..3.Q.petraea
          7.Scales of cupule are glabrous and tuberculate; intercalary veins are present. 4.Q.polycarpa
      4.Petiole is ungrooved and twigs are tomentose
        8.Has persistent stipules; petioles 2-6mm long. 5.Q.frainetto
        8.Stipules not persistent
          9.Blades with 4-7 pairs of lateral veins; sinuses 1/3 to 1/5 the breadth of the lamina
            10.Petiole 15-25mm; broad obovate leaves up to 16cm. ...6.Q.vulcanica
            10.Petiole 5-12mm; leaves obovate-oblong, 4-10cm. 7.Q.pubescens
          9.Blades with 7-12 pairs of lateral veins; sinuses 1/6 to 1/5 the breadth of the lamina. ...8.Q.macranthera
    3.Leaf margins entire or serrate
      11.Singly or doubly toothed serrate margins; leaves glabrous above, eliptic-obovate; 10-20 pairs of lateral veins. 9.Q.pontica
    3.Leaf margins lobate or serrate or entire
      12.Shallowly lobed or serrate blades with entire margins at base; glabrous above, pubescent below

8-11 pairs of lateral veins. 10.*Q.boissieri*

2.Leaves are semi-decidous

13.Entire at leaf base and lobed towards tip; leaves glabrous, 4-6cm; peduncle is short or sessile. ...11.*Q.infectoria*

1.Acorns ripening within the second year

14.Leaves are evergreen

15.Lower leaf surface is tomentose; leaf margins are entire or irregularly serrate

16.Leaves 1.5 to 3 cm in length, oblong-obovate; iregularly toothed. 12.*Q.aucherii*

16.Leaves 3-7 cm in length, oblong-ovate to lanceolate. 13.*Q.ilex*

15.Lower leaf surface is glabrous; leaf margins are undulated

17.Spinespoint toward tip of leaf; leaf margin not cartilagenous; cupule scales are recurved. ...14.*Q.calliprinos*

17.Spines spread outward; leaf margins are more or less cartilagenous; cupule scales are compact. 15.*Q.coccifera*

14.Leaves are deciduous

18.Leaves variably lobate

19.Stipules are persistent; 4-7 pairs of lobes; petiole 8-15mm long. 16.*Q.cerris*

18.Leaves simple with serrate margins

20.Leaves tomentose with short bristles on teeth. 17.*Q.brantii*

20.Leaves glabrous

21.Long bristles on teeth; 7-12 pairs of acuminate teeth; leaves 5-10 cm in length. ..18.*Q.libani*

21.Short bristles; 8-14 pairs of subaristate teeth; leaves 3-7 cm in length. 19.*Q.trojana*

14.Leaves are semi-deciduous

22.Leaves are tomentose beneath, oblong-ovate, 6-10 cm in length; margins have triangular aristate lobes. 20.*Q.macrolepis*

A synoptic classification of the Turkish oaks according to the system of A. Camus (1936-38):

[Subgenus Cyclobalanopsis Schneider (cupular scales concrescent & concentric 77 spp. in East Asia (Malaysia) not reported from W. Asia, but some oaks from Turkey with concentric cupular scales]

Subgenus Euquercus Hickel et Camus

Section Cerris spach

subsect.: Cocciferae Schott. (Q. coccifera L., Q. calliprinos Webb., Q. aucherii Jaub. et Spach.)

subsect.: Macrolepides A. Camus (Q. libani Oliv., Q. aegilops ssp. brantii Lindl, Q. aeg. ssp. macrolepis ky., Q. aeg. ssp. vallonea ky., Q. trojana Jaub. et Spach)

subsect.: Eucerris Oersted (Q. cerris L.)

Section Mesobalanus A. Camus

subsect.: Ponticae A. Camus (Q. pontica Koch)

subsect.: Macrantherae A. Camus (Q. macranthera Fisch. et Mey.)

Section Lepidobalanus Endl. (= Subgenus Quercus)

subsect.: Ilex Liebmann-Oersted (Q. ilex L.)

subsect.: Galliferae (Spach) Gurke (Q. infectoria Oliv.)

subsect.: Hartwissianae A. Camus (Q. hartwissiana Steven)

subsect.: Sessiliflorae A. Camus (Q. sessilis Ehrh. = Q. petraea Liebl., Q. dschorochensis Koch, Q. pinnatiloba Koch, Q. iberica Steven, Q. lanuginosa Lam.)

subsect.: Pedunculatae A. Camus (Q. robur L. = Q. pedunculiflora Koch = Q. haas ky.)

[subsect.17: Sadlerianae Trelease (Represented by Q. sadleriana R. Br. in northern Calif. & S.W. Oregon, but closely related to Q. pontica Koch classified under Sect. Mesobalanus by A. Camus).]

[subsect.18: Prinoideae Trelease (Includes Q. prinus L. = Q. montana Willd., Q. muhlenbergii Engelm., Q. prinoides Willd. Related to subsect. 17 and both subsects. related to subsect. Ponticae under Section Mesobalanus]

The classification of the Turkish oaks in the subgeneric system proposed by O. Schwarz (1934, 1936-37, 1964).

Subgenus Quercus (= Lepidobalanus (Endl.) Oersted)
- Section Roburoides Schwarz
  - subsect.: Castaneiformis Schwarz
    - ser. Ponticae (Stef.) Schwarz (Q. pontica K. Koch)
    - [ser. Sadlerianae Trel. (Q. sadleriana R. Br. in Calif.]
  - subsect.: Roburiformis (Q. petraea (Mattuschka) Liebl., Q. p. ssp. iberica (Stev.) Krassiln., Q. polycarpa Schur., Q. dalechampii Asch. et Gr.)
- Section Robur Rchb. (Q. hartwissiana Stev., Q. robur L.)
- Section Dascia Kotschy (Q. macranthera Fisch. et Mey. = Q. syspirensis K. Koch, Q. frainetto Ten. = Q. conferta Kit., Q. vulcanica Boiss. et Heldr., Q. pubescens Willd.)
- Section Gallifera Spach (Q. boissieri Reut., Q. infectoria Oliv.

Subgenus Cerris (Spach) Oersted
- [Section Suber Spach (Q. Suber L. only under cultivation in Turkey)]
- Section Vallonea Schwarz (Q. brantii Lindl., Q. macrolepis Kotschy)
- Section Erythrobalanopsis Oerst. (Q. libani Oliv., Q. trojana Webb)
- Section Eucerris Oerst. (Q. cerris L.) [Q. castaneifolia C.A. Mey not recorded from Turkey, but present in Upper Miocene of Ankara]

Subgenus Sclerophyllodrys Schwarz
- Section Ilex (Endl.) Oerst. (Q. ilex L.)
- Section Coccifera spach (Q. calliprinos Webb., Q. coccifera L. Q. aucherii)

[Erythrobalanus (Oerst) Schwarz, with 175 spp. from North and Central America (Q. rubra L, Q. coccinea Muench, Q. palustris Muench. in cultivation only.]

The Hybrid oaks of Turkey (Based on the available collections examined and the hybrids reported by Bean, 1976, Camus, 1936-1954, Karamanğlu, 1976, Kasaplıgil, 1947, Kotschy, 1867, Menitsky, 1968, 1972; Rechinger, 1938; Schwarz, 1934, 1936-1937, 1964; Zohary 1961):

Q. x auzendi Gren. et Godr. (= Q.coccifera x Q.ilex) from S.France, introduced into cultivation in Europe. Possibly, the same as Q. x aucherii).

Q.boissieri x Q.pubescens
Sterile specimen from a denuded coppice. Erzincan Prov., Arapkir distr., Dutluca subdistr., alt. ca. 1300m. (Ahmet İpiçürük No. 5 and 34 Adıyaman, Taslıyazı, alt.850m. of Turkish Forestry Service); Hakkari Prov. Semdinli Distr., Alt. 1450m in pure stands, (Cavit Araz No. 3, Turkish Forestry Service) Malatya-Hekimhan, Akpinar Locality. (B. Kasapligil No. 5097 ex A.Tuncer, T.F.S.)

Q.brantii x Q.boissieri
[Fertile specimens growing in pure stands. South eastern Anatolia, Diyarbakır Province, Lice Distr., Hani Subdistr. Takyanos series, alt. ca. 950m. (Cavit Araz No. 8 Turkish Forestry Service)]

Q.brantii x Q.vulcanica
[Diyarbakır Prov.:Lice Distr., alt. 950m. (Cavit Araz, T.F.S.)]

Q.calliprinos x Q.coccifera
[B. Kasaplıgil,(a very common hybrid between the two closely related spp. in western and southern Asia Minor; Mersin, Kuzuncubelen (Kasaplıgil No. 5107 ex E.H. Bozakman)].

Q.cerris x Q.infectoria
[B. Kasaplıgil No. 5030, N. Anatolia, alt. 600m.]

Q.cerris x Q.libani
[Not to be confused with Q.x libanerris Boom from Netherlands. Maras Prov. : Akerdağ (E.K.Balls No. 994)].

Q.cerris x Q.pubescens ssp. anatolica
[Common in Anatolia (B.Kasaplıgil No. 4874, U.C.Davis No. 6515); Konya Prov.:Kadın Hanı, Yukdur Distr. (B. Kasaplıgil No. 4874)].

Q.frainetto x Q.brachyphylla
[=Q.conferta x Q.brachyphylla tomassinii, Schwarz, E. Thrace:Istrancadağ(Mattfeld No. 3549, 3933, 3937)]

Q.frainetto x Q.polycarpa
[=Q.conferta x dschorochensis,Shwarz, E. Thrace: Istrancadağ (Mattfeld No.3657)].

Q.frainetto x Q.pubescens
[=Q.conferta x Q.pubescens, Shwarz in vicinity of Istanbul: Beykoz(DinglerNo. 111), Üsküdar (Krause No. 3200); B. Kasaplıgil No. 3384, Zonguldak; Istanbul Prov: Çatalca, Durusu, (V.Yönelli No. 32); Zonguldak Prov.: Çaycuma, (M. G. No. 32); Çaycuma, Kilimli distr., (M.G. No. 33); E.Thrace: Istanbul, Çatalca, Durusu, alt. 160 m., (Vedad Yönelli No. 32).]

Q.frainetto x Q.vulcanica
Ankara Prov.: Çubuk distr., near Karagöl, alt. ca. 1500m., on the western slope of the dormant volcano,(S.Erik No. 479, Sept. 9, 1973.)

Q.hartwissiana x Q.petraea
[Sterile specimen from Trabzon Prov., southern slopes of Zigana Pass, Alt. ca. 2000m., (Kasaplıgil No. 5281, Sept. 8,1976)]

Q.hartwissiana x Q.petraea ssp.iberica
[Q.armeniaca x Q.iberica, Schwarz, N.Anatolia: Trabzon (Ky.No.385a); Trabzon: Zigana Pass, Southern Slopes, Alt. 2000m. (B. Kasaplıgil, 1976)].

Q.hartwissiana x Q.polycarpa
[=Q.armeniaca x Q.dschorochensis,Q.pseudo-dschorochensis, Q.sessiles var. dschoro-chensis, Schwarz, N.E. Anatolia:Gümüşane (Schnell in Ky.Rev. No.39)].

Q.infectoria x Q.boissieri
Sterile specimens from pure stands of denuded coppice. Eastern Anatolia :Adıyaman Prov., Taşlıyazı village, Harmandere Forest, Alt.850 m., Ahmet Ipiçürük No. 34 and 36 Turkish Forestry Service,Oct. 4, 1974.

Q.infectoria x Q.polycarpa
[Istanbul Prov.:Belgrad Forest (O.Schwarz in Rechinger)].

Q.infectoria x Q.pubescens
[Schwarz, B.Kasaplıgil, ex M.Posat No. 11, Kocaeli Prov.: İzmit; B.Kasaplıgil No.4875, Konya Prov.: Kadınhan; B.Kasaplıgil No.4733, İzmir Prov.: Bergama, Kapıkaya Village].

Q.infectoria x Q.robur
[İstanbul Prov.:Ortaköy and Beykoz along the Bosphorus (O.Schwarz in Rechinger)].

Quercus x libanerris Boom.
A cultivated hybrid between Q.libani and Q.cerris reported from Rotterdam, Netherlands

Q.libani x Q.brantii
Fertile specimens from a denuded coppice, associated with Fraxinus. Hakkâri Prov.: Üzümcü Village, Çimen Community forest, Zapsuyu series, alt. ca. 1200m. (Cavit Araz No. 8) Turkish Forestry Service,Bingöl, Ağaçeli Forest,Alt. ca. 1250 m.(Cavit Araz No. 9) Turkish Forestry Service.

Q.libani x Q.boissieri
(Kasaplıgil No. 5090, ex I.Bozakman, Konya Prov.: Akşehir, Dereli, alt. 500m.)

Q.macranthera x Q.pubescens
Sterile specimen from Hakkâri Prov., Şemdinli Distr., Alt. 1750m., Associated with Sorbus.(Cavit Araz No.6)

Q.macrolepis x Q.cerris
[=Q.aegilops x Q.cerris, Schwarz 1934, N.W. Anatolia: Erenköy, (Sintenis Nos. 1883

1196); Troy (Virchow).]

Q.petraea x Q.cerris
Sterile specimen from E. Thrace: Kırklareli Prov., Vize Distr., Kızılağaç village, Kiremithane series, Alt. 200m., exp.:East, in pure stands, 20m. high, Ø 30cm.

Q.petraea x Q.pubescens
[Ankara Province, Çubuk Distr., in the vicinity of Karagöl, alt. ca. 1550m. on the volcanic Western slopes, associate with Populus tremula. (S.Erik No. 480); Sinop Prov.: Ayancık, (M. Şahin No. 24); Istanbul. (Schwarz in Rechinger)].

Q.petraea x Q.robur
[=Q.rosacea Bechst., Kocaeli Prov.: Adapazarı, Uğurlu Village (M. Posat, Turkish Forestry Service No. 7)].

Q.polycarpa x Q.brachyphylla
[=Q.dschorochensis x brachyphylla tommasinii, Schwarz, E. Thrace: Istirancadağ(Mattfeld No. 3373, 3551)].

Q.polycarpa x Q.petraea ssp.iberica
[=Q.dschorochensis x iberica, Schwarz; Q.pubens Ky. in Sched., Q.pubescens var. pubens Wenzig, N. Anatolia: Giresun and Trabzon (Schnell in Ky. Rev. No. 37, 37a.)]

Q.polycarpa x Q.pubescens
[=Q.dshorochensis x pubescens, Schwarz, in vicinity of Istanbul:Tarabya, Bosphorus (Dingler No.99), Anadoluhisarı (Krause No. 2991), N.W. Anatolia: İnegöl (Dingler No. 818)].

Q.polycarpa x Q.robur
[=Q.dschorochensis x pedunculiflara ? , Schwarz, E. Thrace: Belgrad Forest in Istanbul (Mattfeld No. 3172)].

Quercus aucherii. Jaub et Spach, Ill. plant. or., I, p. 113, t. 58 (1842-1843). Syn.: Coccigera aucherii; Gandogar, Flora Europae, 21, p. 64 (1890).

Trees up to 14 m. high; trunk diameter up to 60 cm.; crown shape oval. Terminal buds oval, pubescent, 2-4 mm long and stipules deciduous. Leaf blade 4 cm long, 1-2 cm wide, upper surface pale green-grayish to green and subglabrous, lower side grayish and pubescent; shape: whole lamina symmetrical; apex obtuse, mucronate; base normal obtuse to rounded; margins entire or sinuate and irregularly toothed with both kinds of leaves sometimes occuring on the same tree; if serrate: apical side concave, basal side concave to somewhat widely acuminate; no glands on teeth; sinuses rounded; spacing regular; serration simple; ours, on upper part of lamina; cuspidate tip; outline oval-oblong=elliptical; texture coriaceous, petiole yellowish-brown, pubescent, 2-6 mm long and not grooved; midrib wavy; pedicel of fruit very short; fruit cylindrical, 3.5 cm long, 10-16 mm thick, purplish brown; cupule bell-shaped, covering 1/3 or 1/4 of acorn, cupular bracts triangular, appressed at base, free at tips, densely pubescent.

Venation: if margin entire, brochidodromous; if margin serrate, semicraspedodromous; primary vein stout, straight to slightly sinuous; secondary veins not parallel, directed towards teeth; moderate acute angle to wide acute toward base of lamina; angle of divergence 40-65 degrees; uniform; moderate width; if margin entire, curved abruptly (brochidodromous condition): if margin serrate: curved uniformly (craspedodromous condition); loop-forming branches mostly at right angles, rarely acute, seldom, composite intersecondaries present; secondary veins both opposite and alternate along midrib; tertiary veins: lower ones at right angle or subright, upper ones at right angle; percurrent: mostly forked, sometimes simple, sinuous, oblique; angle of tertiaries decrease towards apex, mostly alternate, often opposite; higher order of venation: the highest order of vein 5th degree; no excurrent branching, secondaries branch to form loops; quaternary veins at moderate width, random; ultimate marginal venation: fimbrial, of tertiary size; areoles: mostly rounded quadrangular and triangular shape, small; veinlets none or simple linear, sometimes curved, rarely branched once.

Distribution: Mainly southwestern Anatolia (see the map), associated with Pinus brutia, Juniperus and Ceratonia along the coastal regions.

Localities: B. Kasaplıgil I. Batat #5075, ex. Meyer and Peşmen, S.W. Turkey, Aydın Province, Akçakonak, along the road to Pirianne; Kenan Alpacar #9 Turkish Forestry Service, S.W. Turkey, Antalya Province, Finike District, Belen Village, altitude 600 m.; K. Alpacar #27

Turkish Forestry Service, S.W. Turkey, Antalya Province, Elmalı District, altitude 1350 m.; K. Alpacar #54 Turkish Forestry Service, S.W. Turkey, Antalya Province, Fenike District, Belen Village, altitude 550 m.; B. Kasaplıgil #5076, S.W. Turkey, Muğla Province, between Karaböğürtlen and Muğla.

Quercus aucherii may represent a hybrid species between Quercus ilex and Q. calliprinos since foliar characteristics are intermediate between these two evergreen species. However, the fruit and cupular characteristics are quite different from those of the possible parental species as seen in the illustrations at the end.

Quercus boissieri Reut. ex Boiss. Diagn. Ser. 1, 12, p. 119 (1853). syn: Q. infectoria ssp. boissieri (Boiss.) Gürke, Pl. Eur. 2, p. 69 (1897); Q. lusitanica ssp. orientalis DC., Prod. 16 (2):18-19 (1864); Q. infectoria Tchihatchef, Asie min. Bot. 2:18 (1864); Q. petioloris Boiss. Diagn. 1 (12):120 (1853); Q. tauricola Kotchy Die Eichen tab. 10 (1862); Q. inermis Kotchy in Unger and Kotschy, Cypern. 215 (1865); Q. pfaeffingeri Kotschy Die Eichen tab. 23 (1862); Q. boissieri spp. petiolaris (Boiss.) Schwz. Notizbl. Bot. Gart. 13:17 (1936); Q. araxina (Trautv.) Grossh. Fl. cauc. 2:23 (1930).

Deciduous trees up to 12 m in height with a diameter of 60 cm. Young twigs glabrescent; at maturity covered with white, solitary hairs. Terminal buds ovoid, brown, glabrous, bud scales oblong and stipules persistent. Leaf blade oblong-elliptical, size: 1.5-10 cm long and 1.5-4.3 cm wide, grayish green and glabrous above, yellowish green and puberulent below and microphyllous to mesophyllous; shape: whole lamina symmetrical, base mostly symmetrical; normal oblong to narrow obovate, sometimes narrow to wide; apex: acute to obtuse, apical lobe acute to obtuse; base mostly rounded, sometimes auriculate; margin: entire to widely crenate or serrate, 1/3-1/2 to apex; apical side of teeth straight, basal side convex; no glands on teeth apices; sinused rounded; spacing regular; simple venation; extent of serration variable; apex cuspidate. Petiole yellowish brown, 5-10 mm long and not grooved. Midrib straight. Fruits almost sessile, cups obovate or hemispherical, bracts appressed and prominently tuberculate, densely pubescent; acorns cylindrical-ovate, halfway enclosed within cupule, mucronate at apex, approximately 4 cm in length.

Venation: if margin entire of crenate-brochidodromous, if margin serrate-craspedodromous; primary vein; moderate to stout; straight, sometimes sinuous toward apex; secondary veins; if margin entire: wide acute to right angles; if margin not entire: narrow to

moderate acute; upper secondaries more acute than lower secondaries; moderate width; if margin entire or crenate: curved abruptly, if margin serrate: straight; where loop-forming branches exist, joined at right to obtuse angles; rare, composite intersecondaries from midvein in serrate condition, frequent, simple intersecondaries in entire margin; secondary veins not parallel; directed toward teeth with an angle of divergence of 31-61 degrees; 6-12 pairs secondary veins either alternate or subopposite along midrib; tertiary veins from lower to right angles, upper ones at right angle; percurrent: mostly forked, sometimes simple straight; if margin entire: tertiaries close to parallel to midvein, if margin serrate: oblique, tertiary angle decreases upward; alternate; higher order of venation: the highest order -- 5th degree, sometimes 6th degree; no excurrent branching; quarternary veins--moderate, orthogonal; quinternary veins--moderate to thick, orthogonal to random; ultimate marginal venation fimbrial, or tertiary size; areoles: irregular, often quadrangular; small; veinlets usually linear to branched twice, often more than one veinlet per areole; sometimes none.

Distribution: Mainly S.E. Anatolia, but some in S.W. Anatolia as well as along the Mediterranean coasts of Southern Anatolia. Mostly in denuded coppices associated with Pinus brutia, Juniperus spp., Pistacia, Daphne, Sorbus, Platanus, Ulmus, Quercus calliprinos, Q. cerris, Q. libani, Acer hyrcanum, A. obtusifolium, Ostrya carpinifolia, Fraxinus ornus, Pyrus syriaca, Ostrya carpinifolia. Q. boissieri usually occupies semi arid and arid regions of the Middle East extending southward to Lebanon, Syria and Israel and from eastern Anatolia through northern Iraq, it reaches Transcaucosus and northern Iran. It also occurs in western Cyprus.

Localities: C. Araz #21 Turkish F.S., E. Turkey, Bingöl Province, Ağaceli Village, Yayladüzü Arş Forest, altitude 1250 m.; A. Ipiçürük #7 T.F.S., E. Turkey, Malatya Province, Arapkir District, Dutluca Subdistrict, altitude 1300 m.; A. Ipiçürük #31 T.F.S., E. Turkey, Malatya Province, Hekimhan District, Akpınar locality, altitude 1000 m.; C. Araz #5 T.F.S., S.E. Turkey, Diyarbakır Province, Lice District, Taykanus ruıns, altitude 850 m.; A. Gökşin #12, S. Turkey, Adana Province, Osmaniye District, altitude 800-900 m.; A. Ipiçürük #25 T.F.S., E. Turkey, Malatya Province, Pötürge District, Bozkır Village, altitude 1000 m; A. Ipiçürük #19 T.F.S., E. Turkey, Malatya Province, Doğanyol District, Gökçe Village, altitude 900 m.; C. Araz T.F.S. #18, E. Turkey, Bingöl Province, Uzundere Village, Beluzar Forest, altitude 1350 m.; A. Ipıçürük #35 T.F.S., E. Turkey, Adıyanam Province, Taşlıyazı Village, Haramidere Forest, altitude 850 m.; C. Araz #1 T.F.S.,

E. Turkey, Elaziğ Maden, altitude 900 m.; C. Araz #2 T.F.S., E. Turkey, Siirt Province, Şirnak District, Şenola Village, Sivridağ, altitude 1000 m.; C. Araz #5 T.F.S., S.E. Turkey, Bitlis Province, Narlıdere District, Bocan Village, Dedetan Series, altitude 900 m.; H. Peşmen- A. Güner #1924, S. Turkey, Isparta Province, Eğridir District, altitude 850-1200 m.; K. Alpacar #24 T.F.S., S.W. Turkey, Muğla Province, Köyceğiz District, Çayhisar Village, altitude 800 m.; K. Alpacar #23 T.F.S., S. Turkey, Antalya Province, Finike District, Aykırıçay, altitude 700 m.; K. Alpacar #21, T.F.S., S. Turkey, Antalya Province, Finike District, Belen Village, altitude 600 m.; K. Alpacar #22 T.F.S., S.W. Turkey, Muğla Province, Köyceğiz District, Gökbel Forest, altitude 270 m.; C. Araz #19 T.F.S., E. Turkey, Bingöl Province, Yumaklı Village, Genç Series, altitude 1130 m.; C. Araz #13 T.F.S., E. Turkey, Hakkâri Province, Beytüş_şebap District, Beşağaç Village, altitude 1650 m.; C. Araz #3 T.F.S., E. Turkey, Diyarbakır Province, Kokulu Pınar locality, Hani District, altitude 900 m.; A. İpiçürük #2 T.F.S., E. Turkey, Erzincan Province, Ekrek Village, altitude 1400 m.; Peşmen #3354, E. Turkey, Bitlis Province, Tatvan District K. Alpacar #53 T.F.S., S.W. Turkey, Finike District, Belen Village, altitude 600 m.; A. Gökşin #18a T.F.S., S. Turkey, Adana Province, Osmaniye District, Nurdağ, altitude 830-1000 m.; K. Alpacar #33 T.F.S., S. Turkey, Antalya Province, Akseki-Murt, Kabız Road, altitude 450 m.; K. Alpacar #32 T.F.S., S. Turkey, Antalya Province, Akseki District, Kuyucak Subdistrict, altitude 1150 m.; K. Alpacar #11 T.F.S., S.W. Turkey, Antalya Province, Finike District, Aykırıçay subdistrict, altitude 700 m.; C. Araz #3 T.F.S., E. Turkey, Elazığ Province, Maden District, altitude 1020 m.; C. Araz #4 T.F.S., E. Turkey, Siirt Province, Şırnak District, Kızılsu Series, altitude 750 m.; C. Araz #6 T.F.S., E. Turkey, Bitlis Province, Narlıdere District, Bocan Village, altitude 910 m.; A. İpiçürük #20 T.F.S., E. Turkey, Malatya Province, Doğanyol District, Gökçe Village, Memnundere Forest, altitude 900 m.; A. Ipiçürük #11 T.F.S., E. Turkey, Malatya Province, Övledik Geçidi District, on the slopes of Keban Gölü, altitude 1450 c.; B. Kasaplıgil #5091 S. Turkey, Adana Province, Kozan District, 18 km. from Buruk Village, altitude 300 m.; B. Kasaplıgil #5099, S. Turkey, Mersin Province, Camilli Village.

Quercus boissieri is related to Q. infectoria and Q. pubescens. The intermediate forms between these species are common. In fact, Camus (1937) and Menitski (1968,1971) consider Q. boissieri as a subspecies of Q. infectoria. It also hybridizes with Q. brantii producing fertile hybrids. Its wood is used mainly for fuel and charcoal production. Unfortunately, most of

the coppices are in denuded condition due to overgrazing and human pressure. It is a hardy oak suitable for reforestation. Q. boissieri is a beautiful tree with grayish-green foliage suitable for landscaping. Although most of the naturally growing ones are in shrubby habits, they do have tremendous potentiality to reach enormous sizes under protection.

Quercus brantii Lindl., Bot. Reg. 26 suppl. 41 (1840). Syn: Q. persica Jaub. et Spach. Pl. Or. 3,1: tab. 55 (1842-1843); Q. brantii ssp. persica Jaub. et Spach. O. Schwarz, Notizbl. Bot. Gart. Berlin 13, 116:19 (1936); Q. baneica Djavanchir. Les chenes de l'Iran 123 (1967); Q. globularis Djav. Les chenes de l'Iran 127 (1967); Q. saii Dajv. ibid 143 (1967); Q. ungeri Djav. ibid 151 (1862); Q. aegilops ssp. brantii Lindl. 1936-38. A. Camus Monogr. du Gen. Quercus 1:544 (1934).

Deciduous tree up to 15 m high. Twigs densely tomentose; greenish brown. Buds ovoid, 3-8 mm long, pubescent, scales ovoid and stipules persistent. Leaf blade ovate or oblong-elliptical, 2.9-11.4 cm in length, 1.6-6.8 cm wide, upper surface dark green, lower surface gray green, both sides densely tomentose, whole lamina symmetrical, base symmetrical to slightly asymmetrical; from-narrow elliptic to mostly wide elliptic; apex acute to obtuse, mucronate; base cordate to sub-auriculate. Margins serrate, apical sides of teeth concave; basal side widely acuminate, sometimes spiny; without glands on teeth; sinuses rounded; spacing regular; simple serration; sometimes margins deeply lobed or entire towards base; apex sinuate; base rounded or somewhat auriculate. Petiole yellow, 0.7-2.8 cm long, pubescent and not grooved. Midrib straight, rarely wavy; number of lateral corresponds to number of lobes, usually 8-11 pairs; intercalary veins faintly visible. Cupules hemispherical or conical, with triangular or filiform scales spreading or recurved (Figs. A and C); acorns, 3-5 cm long, 12-22 mm thick, 1/3 of basal portion enclosed within cupules. Apex of fruit flat or convex with mucronate tips.

Venation: craspedodromous; primary vein: moderate width; straight to curved; secondary veins: narrow acute to wide acute (moderate acute at middle area); upper secondaries slightly more acute than lower secondaries; more or less straight, sometimes uniformly curved; no loop-forming branches; no intersecondaries off of the midvein, but rarely branching from a secondary to join a tertiary from an opposite secondary; tertiary veins: if blades narrowly elliptic in shape lower ones at right angles, if widely elliptic: lower ones at wider angles; percurrent: mostly forked, some-

times simple sinuous; oblique, angle of tertiaries decreases in upper leaf area, but otherwise generally remains uniform; alternate and opposite; the highest order of venation,5th degree; no excurrent branching, intersecondaries from secondaries may join tertiaries; quarternary veins at moderate width, orthogonal; quinternary veins thin, mostly orthogonal, but often reticulate; ultimate marginal venation fimbrial, of tertiary size; areoles: mostly quadrangular, often irregular; medium; veinlets mostly simple, often with more than one veinlet in each areole, often branched once.

Distribution: Mainly in Southeastern Anatolia (see figure 4.).

Localities: C. Araz #9 T.F.S.,S.E. Turkey, Diyarbakır Province, Eğil Subdistrict, Boyalı Village, altitude 850 m.; C. Araz #10 T.F.S., S.E. Turkey, Mardin Province, Mazıdağ District, Daşot Village, altitude 1050 m.; C. Araz #13, S.E. Turkey, Diyarbakır Province, Dakyanus Hanı District, 60 km. north of Diyarbakır, altitude 950 m.; A. İpiçürük #48 T.F.S., S.E. Turkey, Fıstıközü Village, Halfeti, Öleturdu, denuded coppice, altitude 800 m.; C. Araz #3, T.F.S., E. Turkey, Siirt Province, Şirnak District, Kızılsu Forest, altitude 750 m.; C. Araz #7 T.F.S., S.E. Turkey, Diyarbakır Province, Çınar District, Sipyak Village, Bölçınar Forest, altitude 850 m.; C. Araz #4 T.F.S., S.E. Turkey, Bitlis Province, Narlıdere District, Bocal Village altitude 900 m.; C. Araz #2 T.F.S., E. Turkey, Mardin Province, Idil subdistrict, altitude 750 m.; C. Araz #2 T.F.S., E. Turkey, Mardin Province, Midyot District, Yolağzı Forest, altitude 1000 m.; C. Araz #6 T.F.S., S.E. Turkey, Diyarbakır Province, Çüngüş subdistrict, Çermik Forest, altitude 900 m.; C. Araz #4 T.F.S., E. Turkey, Diyarbakır Province, Kokulu Pınar Hanı subdistrict, altitude 960 m.; C. Araz #8 T.F.S., E. Turkey, Bingöl Province, Ağaçeli District, Arş Forest, altitude 1250 m.;.

This species is related to Q. macrolepis in western Anatolia and Q. ithaburensis in Syria, Israel and Jordan. It hybridizes with several other species such as Q. libani, Q. boissieri, Q. vulcanica; these hybrids are described under a separate heading. Q. brantii extends eastward through the mountain steppes of eastern Turkey to the Kurdish mountains of Iraq to southwestern Iran forming denuded coppices between the elevations of 700-1800 m. It is usually mixed with the typical elements of the Irano-Turanian steppes. Commonly, it is associated with trees and shrubs such as Pistacia spp., Olea, Ulmus, Amygdalus, Crataegus, Pyrus, Amelanchier, Celtis tournefortii, Berberis, Paliurus spina-christi, Juniperus oxycedrus, Sorbus and Fraxinus

spp. The most common oaks associated with Q. brantii are Q. boissieri and Q. libani forming savannah-like, denuded forests with loosely scattered small trees. Most of my specimens are collected from small trees 4-8 m. high and their diameters at breast height ranging from 6 to 35 cm. This polymorphic species has many subspecies and varieties which are beyond the scope of this paper, but the interested readers are referred to Zohary's (1961,1973) and Djavaros' (1967) publications.

The wood of Q. brantii is widely used for fuel and charcoal production. Under human and grazing pressures, most of the mixed-broadleaved deciduous forests of Q. brantii are highly denuded. Occasionally, mightly specimens are found in cemeteries by the graveyards of the notables and "holy individuals". This is a hardy and drought tolerant oak with beautiful foliage and crown on a stout bole. Indeed, it is a valuable tree which deserves attention in landscaping of arid and semi-arid lands. As far as I know, there are no cultivated specimens of this oak in the Mediterranean region, nor in California. Unfortunately, there is not enough information in literature regarding its sylvies, seed germination and ecological requirements. It certainly deserves botanical as well as horticultural research for furthering our knowledge about this oak.

Quercus calliprinos Webb. Iter. Hisp.:15 (1838). Syn. Q. pseudococcifera Labill. Icon. Pl. Syr. Rar. 5:9, Pl. 6; Q. fenzlii Ky. Eichen Eur. u. des Orients p. 73-74, pl. 24 (1862); Q. palaestina Ky. ibid, p. 58-59, Pl. 19 (1862); Q. coccifera var. calliprinos (Webb) Menits. Gence Quercus L. Nov. Syst. Akad. Nauk, USSR, 9:136 (1972).

Small trees up to 8 m. high; some larger specimens reaching 1 m. in diameter. Twigs brown and puberulent. Terminal buds single or clustered, round-ovate, brown, 1-4 mm. long, more or less tomentose, scale shape ovate and stipules deciduous. Leaf blade 1.5-5 cm. long, microphyllous, 0.9-2.5 cm. wide, upper surface yellowish green, more golden below, both sides glabrous, outline mostly oblong to lanceolate, rarely ovate, margins not cartilaginous, dentate with sharp teeth oriented towards the apex, base frequently oblique, apex cuspidate; whole lamina, symmetrical, base cordate and sometimes rounded. Margins-entire or serrate. If serrate: apical side concave to straight; basal side concave to straight; glands, rounded, sometimes blunt on basal area; sinuses rounded; spacing regular; serration simple; on complete margin. Petiole golden, pubescent, 2-4 mm. long and not grooved. Midrib

generally straight. Cupules greenish brown, involucral bracts 4-10 mm. long, oblong-linear, appressed at base only, variably curved, but not spiny at tips; acorns dark brown, roundish-oblong, rarely pubescent, 1-1.3 cm. long, 1.2-1.6 cm. thick, mucronate at apex.

Venation: if margin entire-brochidodromous, if margin serrate-semi-craspedodromous, each secondary which enters a tooth arises independently from the midvein and is not a result of secondary branching (compare with Q. coccifera); primary vein: moderate to stout; straight to curved, sometimes zig-zag; secondary veins sometimes parallel, often branching further; veins terminating at teeth; 6-9 pairs; secondary veins opposite or alternate along the midrib; divergence moderate acute to wide acute or at right angles; upper secondaries more acute than lower ones; thin to moderately thick; subsinuous to sometimes recurved at lamina base; loop-forming branches join mostly at right angles, sometimes acute; rarely composite intercalary veins present; tertiary veins: at lower right angles, upper ones at right angles; percurrent: mostly forked, rarely simple sinuous; running longitudinally at basal lamina area or oblique, tertiaries at decreasing angles upward direction; mostly alternate, often opposite; higher order of venation: the highest order--5th degree; no excurrent branching, secondaries branch to form loops; quarternary veins-thick, orthogonal; quinternary veins-moderate, random; ultimate marginal venation-fimbrial, of secondary size; areoles: mostly rounded quadrangular or triangular shapes; small; veinlets-mostly none or simple linear or curved, sometimes branched once.

Localities: A. Gökşin #11 Turkish Forestry Service, S. Turkey, Maraş Province, Andırın District, altitude 1075 m.; A. Gökşin #10 T.F.S., Andırın District, altitude 1075 m.; B. Kasaplıgil #4864, W. Turkey, İzmir Province, Alaşehir Forest District, in pure stands along foothills K. Alpacar #42 T.F.S., S. Turkey, Antalya Province, Akseki District, Akseki-Manavgat Road in the cemetery altitude 940 m.; A. Gökşin #18 T.F.S., S. Turkey, Adana Province, Osmaniye District, Nurdağ, altitude 830-1000 m.; K. Alpacar #1 T.F.S., S. Turkey, Antalya Province, Bük Research Forest, altitude 500 m.; K. Alpacar #7 T.F.S., S.W. Turkey, Marmaris, between Muğla and Marmaris, altitude 130 m.; K. Alpacar #6 T.F.S., S. Turkey, Antalya Province, Kaş District, Kalkan subdistrict, along the roadside between Kalkan and Fethiye, altitude 162 m.; B. Kasaplıgil #4870, S.W. Turkey, Aydın Province, Söke District, Kızılışık Village.

Quercus calliprinos is the predominant species of macchie occurring widely in the eastern sector of the Mediterranean basin. It is closely related to Q. coccifera. As a matter of fact, Boissier (1879), Schwarz (1934 & 1964) and Menitsky (1972) consider it

as a variety or subspecies of Q. coccifera. On the other hand, DeCandolle (1864), Camus (1936-1938), Wenzig (1887) and Zohary (1961) recognize specific rank for it. Intermediate forms between Q. calliprinos and Q. coccifera are quite common in Asia Minor. However, the distinction between the two species are thoroughly investigated by Zohary (1961). Q. coccifera is primarily a small, shrubby, evergreen oak in the western section of the Mediterranean basin while Q. calliprinos often has arborescent habit, predominantly occurring in the eastern section of the Mediterranean basin. Under protection, they form sizeable trees 8-10 m. high with a stem diameter of 40-100 cm. Hybridization and introgression is noticeable especially in western and southwestern Anatolia where the distributional areas of both species overlap each other. Quercus calliprinos grows successfully especially in calcareous soils of southern Anatolia associated with Pinus brutia, Juniperus oxycedrus, Daphne oleoides, Styrax officinalis, Cistus, Pistacia, Platanus, Sorbus spp. and wild olives. In western Anatolia, it reaches an elevation of 1400 m., while along the Taurus mountain range it grows at the elevation of 1500 m. or even higher. The range of distribution in the south of Turkey extends to Lebanon and Jebel Duruz in Syria (Mouterde 1953, 1966), from Safad to Hebron in Israel (Zohary 1960), from Irbid to Salt and from Tafila to Shaubak and north of Wadi Musa in Jordan (Kasapligil 1956 a,b,c). Q. calliprinos is the most dominant shrub or small tree of the east Mediterranean macchie. The readers are referred to the publications of Zohary (1960, 1973) for the ecological and geobotanical relations of this species. Q. calliprinos is a highly polymorphic species with regard to its habit, morphology and to the great variety of edaphic and climatic habitats of its natural range. Zohary (1961) recognizes seven varieties in the Middle East which are distinguishable through their leaves, fruits and cupules.

Q. calliprinos is a hardy species, cultivated in England. Apparently, the legendary 'Abraham's Oak' in Hebron belongs to this species (Bean 1976). It is considered a sacred tree by the followers of all three religions of the Holy Land, hence no one dares to remove a twig from the aged specimen. However, the open forests of scattered trees are denuded throughout the Middle East since the wood of this species is used widely for fuel and charcoal production.

Quercus cerris L. Sp. Pl. 997 (1753). Syn. Q. austriaca Willd. Sp. Pl. 4:454 (1805); Q. tournefortii Willd. Sp. Pl. 4:453 (1805); Q. tukhtensis Czecott, Acta Soc.

Bot. P. 9:44 (1932); Q. lanuginosa Lam.; Q. cerris ssp. austriaca Willd. Schwarz.

Deciduous tree up to 35 m. high forming pyramidal or broadly open crowns. Twigs rough, glaborous, reddish-brown hairy and linear stipules persistent. Buds ovoid, 1-4 cm. long and bud scales oblong. Leaf blade oblong to narrow obovate or ovate, 4.2-13.8 cm. long, 3.2-6.8 cm. wide, deeply lobed usually 1/3-1/2 to midrib, dark green hairy, and rough to touch above, grayish green and pubescent below; whole lamina symmetrical or asymmetrical, with alternate 4-7 pairs of entire or dentate lobes, base slightly asymmetrical; apex obtuse, apical lobe acute to rounded, sometimes retuse or pointed; base mostly normal obtuse to subcordate, sometimes one side decurrent. Margin-lobate, with alternate, often very deep lobes: apices mostly rounded to rarely bluntly pointed, if pointed possibly with a gland; sinuses rounded; spacing regular; simple and often compound series; on entire margins. Petiole yellow-green, pubescent, 0.8-1.8 cm. long (moderate) and proximal portion grooved. Midrib generally straight.

Venation: craspedodromous; primary vein: moderate to stout; straight to curved; secondary veins: terminating at lobes; rarely branching further; narrow to moderate acute angle, sometimes wide acute in basal area; upper secondaries more acute than lower secondaries; moderate to thick; straight to uniformly curved upward in apical area, downward in basal area, sometimes branching as a secondary or intersecondary to form a secondary lobe (branching occurs on the lower side of a secondary); no loop-forming secondaries, except at base when joining tertiaries; frequent intersecondaries, simple, from midvein in non-lobate areas, sometimes from lower side of a secondary to form a secondary lobe; tertiary veins: lower ones at right angle, upper ones also at right angle, sometimes both angles acute in lobate areas; percurrent: mostly forked, rarely simple straight to sinuous; oblique, the angles of divergence in tertiaries, usually decrease towards apex, predominantly alternate; higher order of excurrent branching--2nd degree; quarternary veins-moderate, orthogonal; likewise quinternary veins moderate, orthogonal; ultimate marginal veins fimbrial of tertiary size; areoles: irregularly shaped, mostly medium, often small; veinlets none or simple linear or branched once. Fruit maturing in the second year, acorns (Fig. 8, C) light brown, 2.5-3.6 cm. long, mucronate, rarely concave at apex; cupules 1.6-2.4 cm. in diameter, 1.5-1.9 mm. deep, enclosing the nuts half way, cup scales linear-filiform, appressed at base, upper scale portions loosely arranged and recurving often.

Distribution: Western sector of the Black Sea coasts of Turkey, throughout Anatolia, except the eastern part. Not recorded from the Saltlake region of Central Anatolia. Very common along the Istranja mountains of eastern Thrace, but absent in the remaining areas of European Turkey possibly due to intensive agricultural land use (see Fig. 9).

Localities: A. Gökşin #13 T.F.S., S. Turkey, Adana Province, Osmaniye District, altitude 800-1000 m.; A. Aldemir #35 T.F.S., N. Turkey, Bolu Province, Mudurnu District, altitude 620 m.,; A. Aldemir #34, Bolu Province, Mudurnu District, Gölcük Series, altitude 500 m.; K. Alpacar #36 T.F.S., S. Turkey, Antalya Province, between Akseki and Manavgat; A. İpiçürük #43 T.F.S., E. Turkey, Adiyaman Province, Gölbaşi District, altitude 850 m.; K. Alpacar #14 T.F.S., S.W. Turkey, Muğla Province, Yaraş District, kıyıt Series, altitude 1020 m.; K. Alpacar #12 T.F.S., W. Turkey, Denizli Province, Acıpayam Road, altitude 950 m.; K. Alpacar #35 T.F.S., S. Turkey, Antalya Province, Manavgat District, altitude 450 m.; V. Yönelli #6 T.F.S., E. Thrace, İstanbul Province, Çatalca District, altitude 80 m.; K. Alpacar #34 T.F.S., S. Turkey, Antalya Province, Akseki District, Murt içi, Kabız Road along the creek, altitude 650 m.; V. Yönelli #5 T.F.S., E. Thrace, İstanbul Province, Çatalca District, altitude 160 m.; A. İpiçürük #47 T.F.S., E. Turkey, Adıyaman Province, Gölbaşı Forest, altitude 850 m.; C. Aksoy, A. Suner, Y. Duğarslan #4 T.F.S., N. Turkey, Tokat Province, Niksar District, Çamiçi Village, İmmidoğan locality, altitude 950 m.; K. Alpacar #46 T.F.S., S.W. Turkey, Muğla Province, Fethiye District, Çengerköy, Hatice ana hill, Kuz locality, altitude 250 m.; A. Aldemir #32 T.F.S., N.W. Turkey, Bolu Province, Mudurnu District, Ilıca Village, Sarot Forest, altitude 440 m.; A. Aldemir #33 T.F.S., N. Turkey, Bolu Province, Mudurnu District, Yürse Series, altitude 480 m.; M. Posat #2 T.F.S., N.W. Turkey, Kocaeli Province, Adapazarı District, Kemaliye Village; M. Posat #23 T.F.S., N.W. Turkey, Adapazarı Province, Akyazı District, Karapürçek Locality; M. Şahin #35 T.F.S., N. Turkey, Samsun Province, Kavah District, Mahmutlu Village; M. Şahin #32 T.F.S., N. Turkey, Samsun Province, Bafra District M. Şahin #29 T.F.S., N. Turkey, Sinop Province, Gerze District, Hatin Village, Dihmen Forest; V. Yönelli #46 T.F.S., N.W. Turkey, E. Thrace, Kırklareli Province, Vize District, Kömürköy Series, altitude 150 m.; Vedat Yönelli #57 T.F.S., E. Thrace, Kırklareli Province, Vize District, Kızılağaç Village, Kiremithane Series, altitude 200 m.; V. Yönelli #61 T.F.S., E. Thrace, Kırklareli Province, Vize District, Kocataş Locality, altitude 10 m.; V. Yönelli #88 T.F.S., E. Thrace, Kırklareli Province,

Demirköy District, Uzunbacak Locality, Karacadağ Series; V. Yönelli #85 T.F.S., E. Thrace, Kırklareli Province, Demirköy District, Istihkâmtepe Forest, altitude 350 m.; V. Yönelli #83 T.F.S., E. Thrace, Kırklareli Province, Demirköy District, Karayokuş Locality, altitude 500 m.; V. Yönelli #81 T.F.S., E. Thrace, Kırklareli Province, Demırköy District, Şarapnel Series, altitude 475 m.; V. Yönelli #80 T.F.S., E. Thrace, Kırklareli Province, Demirköy District, Işletme Locality, altitude 425 m.; V. Yönelli #78 T.F.S., E. Thrace, Kırklareli Province, Dereköy Region, Karlık Series, altitude 430 m.; M. Posat #3 T.F.S., N.W. Turkey, Kocaeli Province, Adapazarı District, Soğucak Village; M. Şahin #21 T.F.S. N. Turkey, Sinop Province, Ayancık District, Bakırlı zaviye Village, A. İpiçürük #32 T.F.S., E. Turkey, Malayta Province, Hekimhan District, Akpınar Forest, altitude 1000 m.; M. Posat #21 T.F.S., N.W. Turkey, Adapazarı Province, Akyazı District, Merkez Subdistrict, Beldibi Locality; V. Yönelli #73 T.F.S., E. Thrace, Kırklareli Province, Merkez Region, Düzorman Series, altitude 500 m.; A. İpiçürük #24 T.F.S., E. Turkey, Malatya Province, Doğanyol District, Gökçe Village, Memonun Forest, altitude 900 m.; M. Posat #8 T.F.S., N.W. Turkey, Kocaeli Province, Adapazarı District, Uğurlu Village, M. Posat #17 T.F.S., N.W. Turkey, Izmit Province, Adapazarı, Şosesi; A. Gökşin #9, T.F.S., S. Turkey, Maraş Province, Andırın District, altitude 1075 m.; A. Gökşin #8 T.F.S., S. Turkey, Maraş Province, Andırın District, Başkonuş locality, altitude 800-1000 m.; K. Alpacar #39 T.F.S., S. Turkey, Antalya Province, Akseki District, 3 km. along Ibradı Road, in cemetery, altitude 940 m.; B. Kasaplıgil #4620 S. Turkey, Burdur Province, Bucak District, Gerce Village; M. Posat #13 T.F.S., N.W. Turkey, Kocaeli Province, Lütfiye Locality; B. Kasaplıgil #5796, E. Thrace, İğneada, Longozlar Forest, H. Peşmen-A. Güner #1486, S. Turkey, Isparta Province, Eğridir, Yaka köyü, altitude 1500-1700 m.; M.G. #34 T.F.S., N.W. Turkey, Zonguldak Province, Kozlu District; A. Aldemir #29 T.F.S., N.W. Turkey, Bolu Province, Göynük District, altitude 1380 m.; M.G. #40 T.F.S., N.W. Turkey, Zonguldak Province, Devrek District, Dirgine, Kazdere Forest; A. Aldemir #31 T.F.S., N.W. Turkey, Bolu Province, Mudurnu District, Ilıca Village, Sarot Forest, altitude 460 m.; A. İpiçürük #41 T.F.S., S.E. Turkey, Adiyaman Province, Gölbaşı Forest, altitude 850 m.; V. Yönelli #32 T.F.S., E. Thrace, İstanbul Province, Çatalca District, Durusu subdistrict, altitude 160 m.; K. Alpacar #18 T.F.S., S.W. Turkey, Muğla Province, Yerkesik District, Kocadüz locality, Narçalıdağ Forest, altitude 550 m.; V. Yönelli #62, T.F.S., E. Thrace, Kırklareli Province, Vize District, Yumurtatepe Series, Kocataş Locality; A. Gökşin #15,

T.F.S., S. Turkey, Adana Province, Osmaniye, Nurdağ, altitude 830-1250 m.; V. Yönelli #10 T.F.S., E. Thrace, Istanbul Province, Çatalca District, Yaliköy Bölgesi, Kozuldere Forest, altitude 20 m.; M. Şahir #28, T.F.S., N. Turkey, Sinop Province, Çerkez Village, Sinop Forest; B. Kasaplıgil #4840, S. Turkey, Antalya Province, Güngdoğmuş District, Vicinity of Senir Village; B. Kasaplıgil #4841, S. Turkey, Konya Province, Akşehir Tekke Village, altitude 1300 m.; B. Kasaplıgil #4859, N. Turkey, Sinop Province, Ayancık, altitude 600 m.; B. Kasaplıgil #4867 E. Central Turkey, Afyon Province, Sandıklı District, Burgaz Mountain; B. Kasaplıgil #4874 S. Turkey, Konya Province, Kadın Hanı District, Yukdur Subdistrict; B. Kasaplıgil #4877, S. Turkey, Konya Province, Ilgın District, Çiğil Subdistrict; B. Kasaplıgil #5028 N. Turkey, İzmit Province, between Akmeşe and İmaniye; B. Kasaplıgil #5031 N.E. Turkey, İzmit Province, Yuvacık; B. Kasaplıgil #5032, S. Turkey, Adana Province, Osmaniye District, Gâvurdağı, altitude 1000 m.; B. Kasaplıgil #5035, S. Turkey, Adana Province, Kozan Forest; B. Kasaplıgil #5077, S. Turkey, Antalya Province, Manavgat Forests; B. Kasaplıgil #5078 N. Turkey, Çorum Province, Hacılar hanı region; B. Kasaplıgil #5109 E. Turkey, between Malatya and Hekimhanı, Akpınar locality.

Q. cerris is the most widely distributed oak in Turkey (Fig. 9). In Europe, it extends from the Balkan Peninsula through Central Europe to France. In the Middle East, south of Turkey, Q. cerris grows along the coastal regions of Syria and Lebanon. In the U.S.A. and Great Britain, it is cultivated in parks and arboretums. It is a quick growing and hardy species suitable for streets especially in cold climatic zones. Several varieties are listed tentatively by Zohary (1961). The natural hybrids of Q. cerris with Q. libani in southern Anatolia and with Q. infectoria in northern Anatolia are recorded. However, Q. x libanerris Boom (1959) described from a cultivated specimen in Trompenburg Arboretum in Holland is not represented in my collections from the natural populations in Turkey. Karamanoğlu (1976) enumerates two subspecies from Turkey. Q. cerris ssp. austriaca (Willd.) Schwarz reaches the elevation 1500 m. in northern Anatolia between Kastamonu and Çankırı (Krause Nos. 2419 & 2424). Q. cerris ssp. tournefortii (Willd.) Schwarz is reported occurring between the elevations of 750-900 m. in Bolkardağı of the Taurus range in Mersin (Kotschy Nos. 386, 405), cf Karamanoğlu (1976). Both subspecies occur in steppic, arid regions as well as in mesic broadleaved forests of the Black Sea coasts of Asia Minor and eastern Thrace. Unfortunately, high forests of pure stands are rare, except in Osmaniye district

of Adana Province, I observed in 1944, a seedling forest of magnificent tall trees mixed with Pinus nigra in Hagbel Frenk locality at the elevation of 1220 m. Depending on the vegetation type of its natural distribution areas in Turkey, Q. cerris associates with a large variety of trees and shrubs: Pinus brutia, P. sylvestris, Q. libani, Q. infectoria, Q. vulcanica, Castanea sativa, Fagus orientalis, Laurus nobilis, Carpinus, Fraxinus, Acer, Arbutus, Platanus, Populus, Phillyrea, Cornus, Paliurus, Mespilus, Sorbus, Melia, Styrax, Staphylea, Alnus, Daphne, Pistacia, Pyrus, Cistus,Calluna, Erica, Smilax, etc.

Along the coastal mountain ranges of the Black Sea coast, Q. cerris is quite an invasive species forming coppice type of forests following the clear cutting of broad-leaved high forests. It has a tremendous capacity of regeneration through suckers and easy establishment of young seedlings. The wood is not desirable for construction purposes, but it is used mainly as fuel wood. Under human and grazing pressures, most of the coppices are in denuded state. Being related to Q. suber = Cork oak, Q. cerris = Turkey oak is classified under Subgenus Cerris (Spach) Örsted by Schwarz (1964). In fact, hybridization between the two has been reported from western Europe. Like Q. suber, Q. cerris also is suitable for cork production. During the World War II, Turkey was unable to import cork from Spain and Portugal. The Turkish Forestry Service commissioned Dr. Kâzım Mıhçıoğlu to investigate and find a substitute for the cork. During early 1940s, Dr. Mıhçıoğlu settled with Q. cerris after a long survey of cork producing trees in Turkey. He established several experimental lots in southeastern Turkey where the primary cork from the barks of aged trees were ax-peeled, punched and used as cork stoppers for bottled beverage industries. The primary cork was too brittle and hard enough to resist the cork screws. However, a few years later, the secondary oak developed from the cork cambium was soft, elastic, and pliable. The foresters of the Osmaniye (Adana Province) called it "female cork" to distinguish from the brittle, porous "male cork" obtained from the primary barks of the trees. The early reports of the cork production from Q. cerris barks were published by Dr. Mıhçıoğlu in the 1942 volume of "Orman ve Av = Forestry and Hunting" journal of the Turkish Forestry Association. At the end of the World War II, Turkey was able to import cork again and consequently the experiments on cork production from the barks of Turkey oak were discontinued.

No doubt, the best use of this species would be in landscaping the streets and parks in the urban areas. In 1959, I planted three seedlings of Q. cerris at the

International Grove of the University of Washington in Seattle during the 5th International Forestry Congress. Twenty years later, when I visited the University of Washington campus again, I located the two survivors which were about 15 m. high with vigorous branching from single boles (Fig. 10). According to Bean (1976), it has been in cultivation in Great Britain since 1735.

Quercus Coccifera L. Sp. Pl.:995 (1753). Syn: Q. pseudococcifera Desf., Q. coccifera var. pseudo-coccifera (Desf.) A. DC., Ilex coccigera Clus.

Small evergreen shrubs or trees 2Ø3 m. high. Twigs grayish brown; pubescent. Terminal buds more or less glabrous, ovoid dark brown, bud scales ovoid and stipules persistent. Leaf blade ovate to wide ovate, rarely oblong, 1.7-5 cm long (usually about 2 cm.), microphyllous, 1.2-2.3 cm. wide, dark green and shiny above, pale green and glabrous below; whole lamina symmetrical, base symmetrically cordate or rounded; apex acute, mucronate. Margins--in ours serrate, with abruptly divarcating spines, more or less cartilaginous with spiny teeth not directed towards the tips of leaves, often radiating outward directions, apex cuspidate, base rarely oblique; if serrate: apical side concave, basal side straight, no glands on teeth; sinuses rounded; with regular spacing; simple serration; or occasionally complete margin. Petiole yellowish brown, pubescentat young stage, soon becoming glabrous, 1-6 mm. long. Midrib straight; rarely wavy. Fruits matruing in two years, concave and mucronate at tip, half way or 2/3 of acorn enclosed within cupule. The scales of the cup radiating in all directions, quite spiny. Fruits develop singly on short stalks, usually abundant.

Venation: semicraspedodromous, where secondary branching occurs almost midway between the margin and midvein, each of the 2 branches enter adjacent teeth; primary vein: stout; straight to subsinuous; secondary veins: mostly medium acute to wide acute angle, tending to right angle and recurved toward base of lamina; upper secondaries at a more acute angle; moderate width; straight and sometimes branching, lower secondaries re-curved; loop-forming secondary branches at acute angle or tight angles; seldom composite intersecondaries; 4-7 pairs of secondary veins terminate at teeth; secondary veins either opposite or alternating along the midrib; tertiary veins: lower ones at wide or right angles, upper ones at right angle; percurrent: mostly forked, rarely simple, sinuous; oblique, tertiary angle decreases upward, lower tertiaries sometimes parallel to midvein; alternate and opposite; higher order of

venation: the highest order--5th degree; highest order of excurrent branching--2nd degree; quarternary veins--thick, orthogonal; quinternary veins--moderate, random; ultimate marginal venation fimbrial, of secondary size; areoles: mostly rounded quadrangular or triangular shapes; small; veinlets mostly none or simple linear, sometimes curved.

Distribution: Mainly southeastern Europe and North Africa, Mediterranean regions of Greece and Turkey.

Localities: B. Kasaplıgil #4682, W. Turkey, İzmir Province, Menemen District, Emiralem, foothills of Dumanlı Dağ, altitude 50 m.; B. Kasaplıgil #4625 S. Turkey, Konya Province, Ermenek District, Merkez subdistrict; B. Kasaplıgil #5105 W. Turkey, Manisa Province, Akşehir Village, altitude 1050 m.; K. Alpacar #26 T.F.S., S.W. Turkey, Muğla Province, Köyceğiz District, Yargı Village, altitude 1300 m.; K. Alpacar #19 T.F.S., S.W. Turkey, Muğla Province, Yerkesik District, Marçalıdağ Forest, Karahayıt locality, altitude 600 m.; K. Alpacar #20 T.F.S., S.W. Turkey, Muğla Province, Gökbel Village, Sarısu Forest, altitude 275 m.; K. Alpacar #41 T.F.S., S. Turkey, Antalya Province, Akseki District, Akseki-Manavgat Road near the cemetery, altitude 940 m.; K. Alpacar #10 T.F.S., S.W. Turkey, Muğla Province, Kavaklıdere Village, Road between Muğla-Aydın, altitude 350 m.; Mehmet Posat #10 T.F.S., N.W. Turkey, Kocaeli Province, İzmit District; B. Kasaplıgil #5070, W. Turkey, between İzmir and Manisa; B. Kasaplıgil #5082, S.W. Turkey, Muğla Province, Fethiye District, Karadere Village; B. Kasaplıgil #5102 S.W. Turkey, Antalya Province, Bükbeli District, altitude 850 m.; B. Kasaplıgil #5103, S.W. Turkey, Antalya Province, Finike District, altitude 500-600 m.; B. Kasaplıgil #5104 N.W. Turkey, Çanakkale Province, Eceabat District, Sarıkız Forest, altitude 850 m.; B. Kasaplıgil #5106, S. Turkey, İçel Province, Mut District, Karabağ subdistrict, 5 km. north of Mut, altitude 1120 m.; B. Kasaplıgil #5107, S. Turkey, Mersin Province, south of Kuzucubelen, altitude 625 m.; B. Kasaplıgil #4835, S.W. Turkey, Denizli Province, Bozdoğan #4839, S. Turkey, Antalya Province, Gündoğmuş District; B. Kasaplıgil #4841 Konya Province, Akşehir Forest District; B. Kasaplıgil #4856, N.W. Turkey, Bursa Province, Gemlik District; B. Kasaplıgil #4862 N.W. Turkey, Edirne Province, Keşan District; B. Kasaplıgil #5048, S. Turkey, Adana Province, Kozan Forest; B. Kasaplıgil #5050 W. Turkey, Manisa Province, Spil Mountain; B. Kasaplıgil #5051, S. Turkey, Mersin Forest.

Q. coccifera commonly known as Kermes oak is a predominant element of the macchie in western and southern Turkey (Kasaplıgil 1952). The vertical range

of the Kermes oak reaches an altitude of 1400 m. in western Anatolia (Karamanoğlu 1976). It is often associated with Pinus nigra, P. brutia, Quercus cerris, Arbutus unedo, A. andrachne, Juniperus oxycedrus, Olea europaea, Phillyrea media, Paliurus spinachristi and many other Mediterranean elements. Under grazing pressure it becomes a creeping shrub which is typical in Phrygana vegetation in Kocaeli peninsula of northwestern Anatolia (Kasaplıgil 1947). Under protection or in cultivation, they become sizable trees about 6-7 m. high. The largest specimen in Turkey measures 8 m. in height with a stem diameter of 35 cm.

Kermes oak is used primarily for fuel and charcoal production. The wood is dense and very hard; that is why it is called Steineiche in German and Taş meşesi (Stone oak) in Turkish. The name Kermes oak is derived from the Kermes insect (Chermes ilicis) which lives on the barks of this oak. The female insects were the source of "grana chermes", an important dye material during the Middle Ages (Baytop 1963). The leaves and fruits are very variable since it hybridizes freely with Q. calliprinos and Q. ilex in nature. It is a beautiful oak with shiny green, spiny foliage resembling Ilex aquifolium. Although several forms of Kermes oak are cultivated in Western Europe, I have never seen them under cultivation in Turkey and in the United States. For the infraspecific classification of Q. coccifera the readers are referred to the monograph of Vicioso (1950).

A provisional list of Miocene oaks of Turkey and their possible relationships to the extant species.

Quercus boissieri Reut. ssp. pesmenii, ssp. nov.
Very close to modern Q.boissieri, leaves obovate, serration sharply pointed towards apex.

Quercus drymeia Unger
Related to Q.sartorii Liebm. from Mexico. Lanceolate blades with sparsely serrate margins, lamina base often rounded. Midrib and petiole strongly developed.

Quercus furcinervis (Rossm.) Heer
It may belong to Castanopsis. lanceolate leaves with craspedodromous venation; lamina tips often curved.

Quercus cf. hartwissiana
Cupule 2 - 2.5 cm. wide with tuberculate scales.

Quercus heidingeri Ettingh.
It has aff. to Q.ilex but leaves are much larger.

Quercus kodorica Kol.
Blade margins shallowly lobed. Midrib and petiole strongly developed.

Quercus kubinyi (Kov.) Cz.
Affinities to Q.macrolepis, Q.libani, Q.trojana; most common oak of Tertiary period found in many fossil deposits of central Europe. See the distrubution map by H. Tralau.

Quercus lonchitis Ung.
Lanceolate or obovate leaves with entire margins.

Quercus mediterranea Ung.
Aff. with Q.ilex. Base of lamina entire, upper 2/3 of lamina coarsely serrate.

Quercus mioaxelrodii sp. nov.
Aff. with Q.castaneifolia + lanceolate leaves. Midrib zig-zag, blade margins serrate.

Quercus miopontica sp. nov.
Aff. to Q.pontica from N. E. Turkey and Abkhasia U.S.S.R., and to Q.sadleriana R. Br. Campst. from N. California and Southern Oregon.

Quercus miovariabilis Hu et Chaney
Roughly resembles chestnut leaves, it is identical with the Chines Miocene species described from Shantung Prov. of China. Palaeont. Sinica, Ser. 112, new Ser. 1, p. 36-37, pl. 15, figs 5, 6.)

Quercus neriifolia A. Braun
It may be related to Q.imbricaria Michx. from East. U.S.A. . Narrowly lanceolate leaves with entire margins, petiole well developed.

Quercus paulmouterdei sp. nov.
Aff. to Q.libani and Q.regia. Cupules are 3-3.5 cm. wide, scales triangular, prominently overlapping.

Quercus sclerophyllina Heer.
Aff. with Q.coccifera =Kermes oak. Petiole short and thick, midrib strongly developed, leaf margins sharply dentate, pointed outwards.

Quercus semecarpifolia fossils
Aff. with Q.sosnovskyi. Leaves 6-7cm. long, 2.5-3 cm.wide, midrib and petiole strongly developed. Secondaries diverging at broad angles. Tuft of hairs at angles.

Quercus seyfriedii A. Br.
Aff. with Q.phellos of Eastern U.S..

Quercus sosnovskyi Kol. f.angustifolia Kol.
It has aff. to Q.glauca Thunb. from Japan. Blader 12-14 cm. long, lanceolate with entire margins. The leaves are quite variable.

THE LEGENDS FOR ILLUSTRATIONS

Figure 1:

Quercus aucherii Jaub et Spach A) A flowering branch with staminate catkins x 1/2 drawing by Anne Crocker; B) Contact prints of two cleared leaves, to the left: with entire margins, to the right: partly dentate blade showing the brochidodromous venation in the lower portion of the lamina and semicraspedodromous condition in the upper portion of the leaf. C) Detail of the minor venation and ultimate areoles, x 30, C1 - areole, C2 - ultimate linear veinlet, C3 - fimbrial vein along the leaf margin; Kasapligil #5075. D) Fruit variation x 1/2, drawings by Elizabeth Fall. D1 - Bell-shaped cupule with imbricate bracts enclosing 1/4 of the slender acorn; D2 - A hemispherical cupule with adpressed scales enclosing 1/3 of a thick acorn. Note the mucronate tips of the acorns. Specimens provided by Kenan Alpacar #54 from Belen village of Antalya Province.

Figure 2:

Quercus boissieri Reut. A) A fruiting branch showing the variation of leaf outlines. Although most of the leaves are obovate, some of them are oblong-elliptical. Drawing by Anne Crocker. B) Acorns with mucronate apices. Note the prominently tuberculate cupule with short pedicel. C) Detail of two leaves with obtuse apices and cuneate bases. D) Contact prints of two cleared leaves showing the craspedodromous venation in the upper dentate-lobate portions of the leaves and brochidodromous venation in the lower blade portions with entire margins. All illustrations x 1/2.

Figure 3:

Distributions of Q. boissieri Reut. (circles), Q. libani Oliv. (solid circles) and Q. trojana Webb. (triangles).

Figure 4:

Distributions of Q. brantii Lindl. (circles) and Q. macrolepis Kotschy (solid circles).

Figure 5:

Quercus brantii Lindl. A) Fruiting branch showing the leaf variation and the young stage of fruit development. Specimen from Silvan south of Muş, T.F.S. #14. Note that the cupular bracts are more or less filiform at an early stage. Drawing by Anne Crocker. B) Contact print of a cleared leaf showing the detail of major

venation, B. Kasaplıgil #4626. Note that the upper secondaries diverging at narrow angles and terminating at marginal teeth while the lower secondaries near the base of lamina diverging at wider angles and reticulodromous where blade margins entire. The tertiaries are oblique in relation to the primary vein. Slide and print by Margret Mukai. C) Variation of mature fruits and cupules. Basal involucral bracts are triangular, imbricately appressed, but their tips are free. The upper scales near the cupular margins are recurved. The specimen to the left: C. Araz #6 T.F.S., from Diyarbakır Province, Fermik Forest; The specimen to the left: A. Ipigürük #51 T.F.S., S.E. Turkey, Fıstıközü Village, Halfeti loc. Both drawings by Elizab. Fall. All figures x 1/2.

Figure 6:

A) Fruiting branch of Q. calliprinos Kasaplıgil #4864. Note that the teeth of the serrate leaves are pointed towards the leaf apex. The involucral bracts of this particular specimen are not recurved and that the cylindrical acorns are halfway enclosed within the cupules. Drawing by Anne Crocker, x 1/2. B) Contact print of a cleared leaf with entire margins showing the brochidodromous venation pattern in which the bifurcating secondaries forming loops. C) Another leaf clearing from the same specimen with dentate margins and semi-craspedodromous venation. Note that the teeth in the lower half of the leaf are pointed ourwardly and that the secondary veins diverge at narrow, right and broad angles. The intercalary veins are evident in both leaf samples (Kasaplıgil #4864). The slides and prints of B & C by Margret Mukai, X 2.

Figure 7:

Quercus calliprinos, details of leaf vasculation, Kasaplıgil #4625. A) Contact print of a serrate leaf with strongly developed primary vein and semi-craspedodromous secondaries alternating with intercalary veins. The teeth are spinescent and pointed toward the leaf apex, x 2-1/2. B) A secondary vein terminating at the tip of a marginal tooth. 2^{o}, 3^{o}, 4^{o}, 5^{o}; veins of the 2nd-5th degrees respectively, mf: marginal fimbrial vein. C) Bifurcation of a secondary vein near the blade margin giving rise to semicraspedodromous condition (bs), (ar): Areoles with compactly arranged palisade parenchyma cells. Photomicrographs by Margret Mukai, x 25.

Figure 8:

Quercus cerris = Turkey oak. A) A fruiting branch with persistent stipules and an immature fruit enclosed within the cupule covered by long, filiform bracts. Kasaplıgil #4620, drawing by Anne Crocker, x 1/2; B) Contact print of a cleared leaf showing the detail of major venation and the frequency of intercalary veins. Note that some of the lobes are coarsely dentate. Kasaplıgil #4620. Slide of leaf whole mount by Joan Amoroso, contact print by Margret Mukai, x 1/2; C) Variation of the mature fruits showing the detail of the cupular bracts. A. Aldemır #32, T.F.S., Bolu province, Mudurnu (left), A. Ipiçürük #46, T.F.S., Adıyaman province Gölbaşı (right). Both drawings by Elizabeth Fall, x 1/2.

Figure 9:

Distribution of Quercus cerris (Turkey oak) in Anatolia and Eastern Thrace.

Figure 10:

Quercus cerris (Turkey oak): A) Contact print of a cleared leaf showing a deeply dissected blade with simple lobes almost reaching the midrib region. Note the lobes and the secondary veins are alternating. Again the intercalary veins are common. See the text for the detailed description of the major and minor venation. Hasan Peşmen & Güner #1486, slide and the contact print by Margret Mukai x 1/2; B and C) cultivated specimens of Turkey oak in the International Grove of the University of Washington, Seattle. The trees were planted by this author in 1959 for commemorating the 5th International Congress of Forestry on behalf of the Turkish Government. The photographs were taken twenty years later on August 10, 1979 by B. Kasaplıgil.

Figure 11:

Quercus coccifera L. Kermes oak. A) A fruiting branch showing the variation of the leaves and acorns in the same individual plant. Kasaplıgil #4625, drawing by Anne Crocker, x 1/2; B-C) Contact prints of cleared leaves showing the detail of the major and minor venations. Note the remarkable resemblance of the foliar vasculature in Q. coccifera and Q. calliprinos (Figs. 6 and 7). Kasaplıgil #4625, both slides and prints by Margret Mukai, x 2.

Figure 12:

Distributions of *Q. aucherii* Jaub et Spach (circles), *Q. calliprinos* Webb. (triangles), *Q. coccifera* L. (solid Triangles), and *Q. ilex* L. (solid circles).

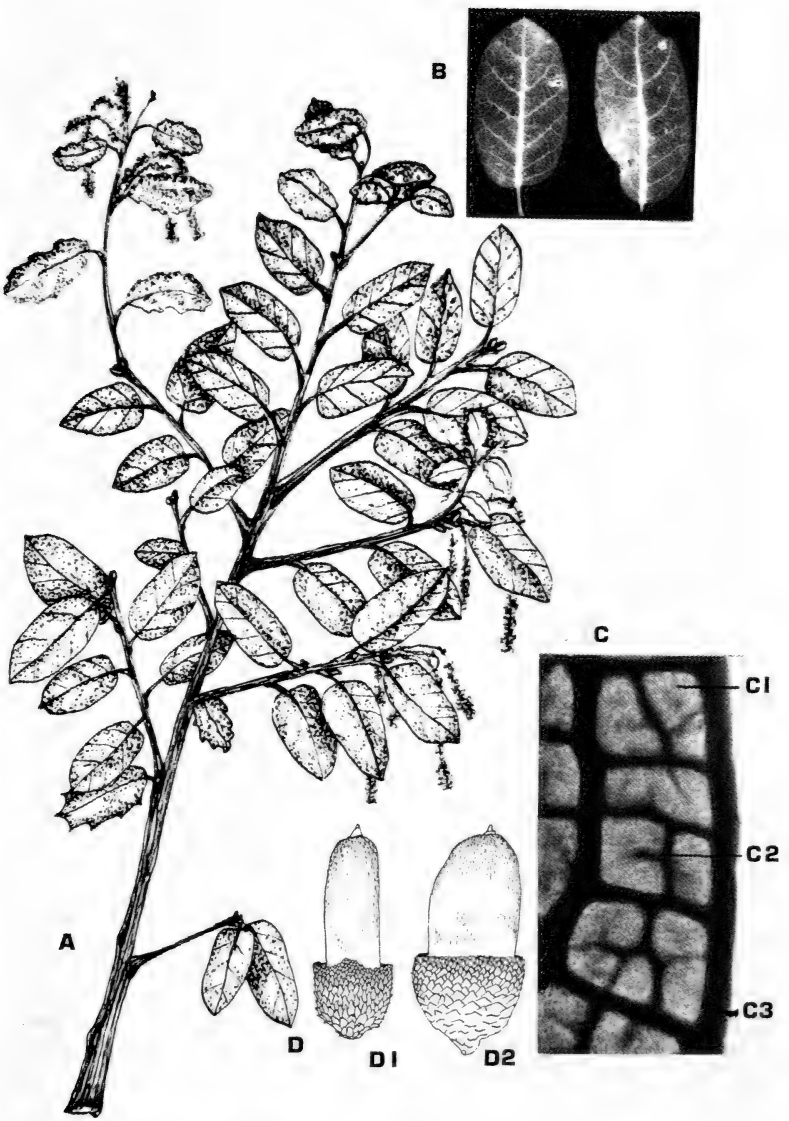


Fig.1. Quercus aucheri

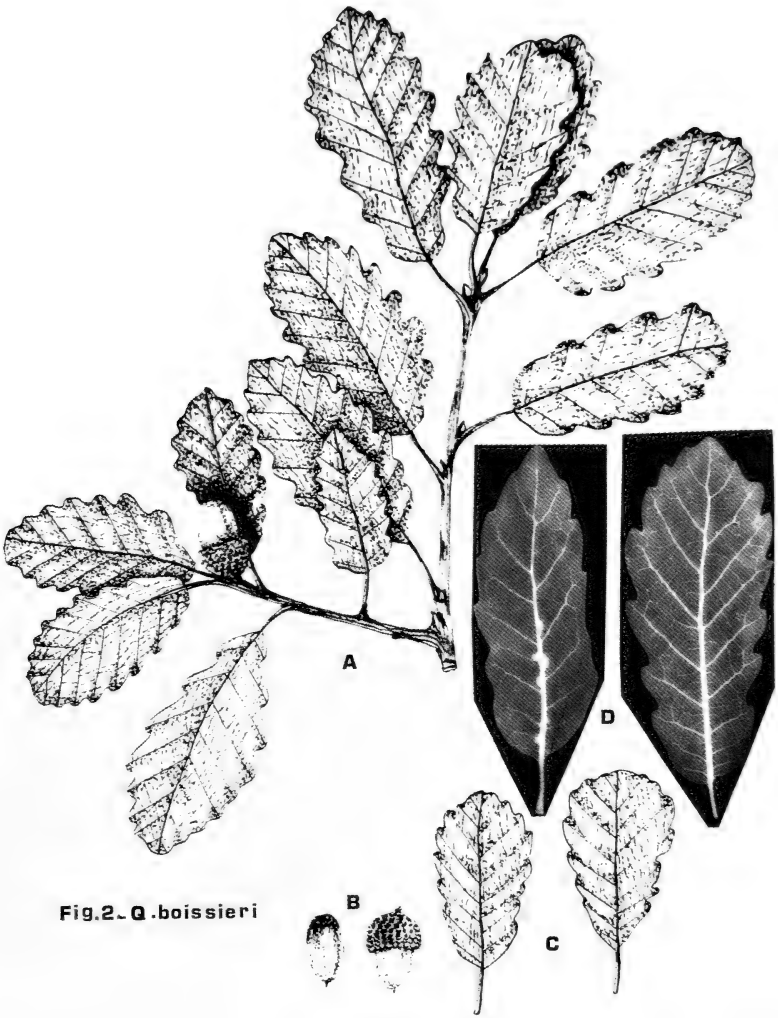


Fig.2-Q.boissieri

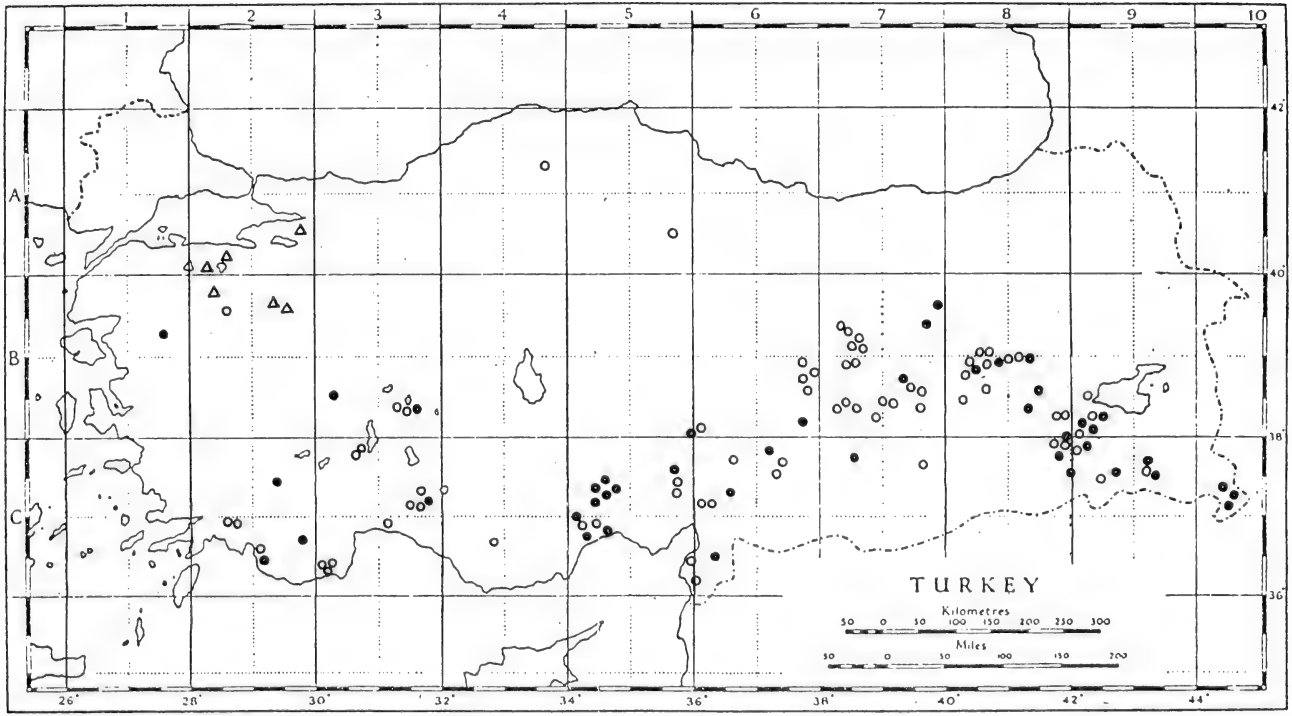


Fig. 3- Distributions of Quercus boissieri (o), Q. libani (•) and Q. trojana (Δ).

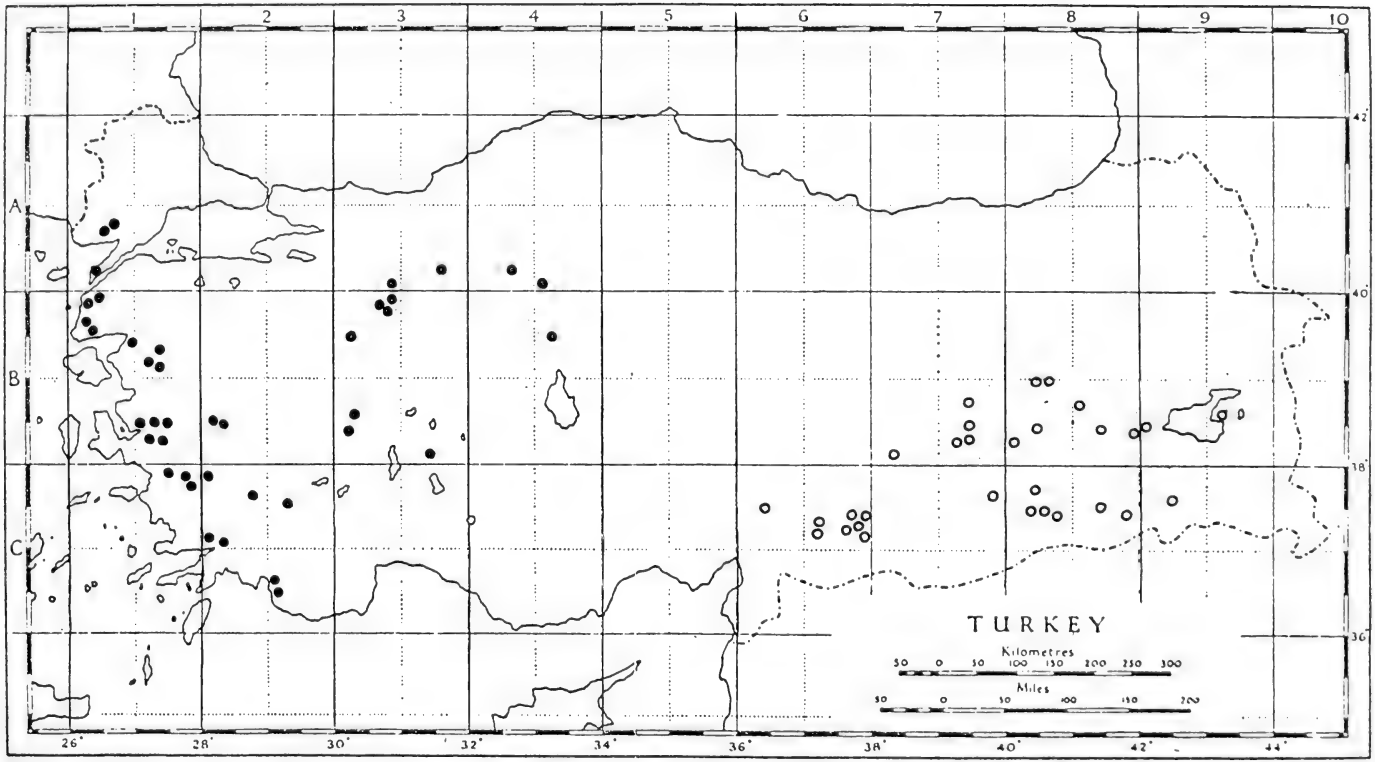


Fig. 4 - Distributions of Quercus brantii (o) and Q. macrolepis (•) .

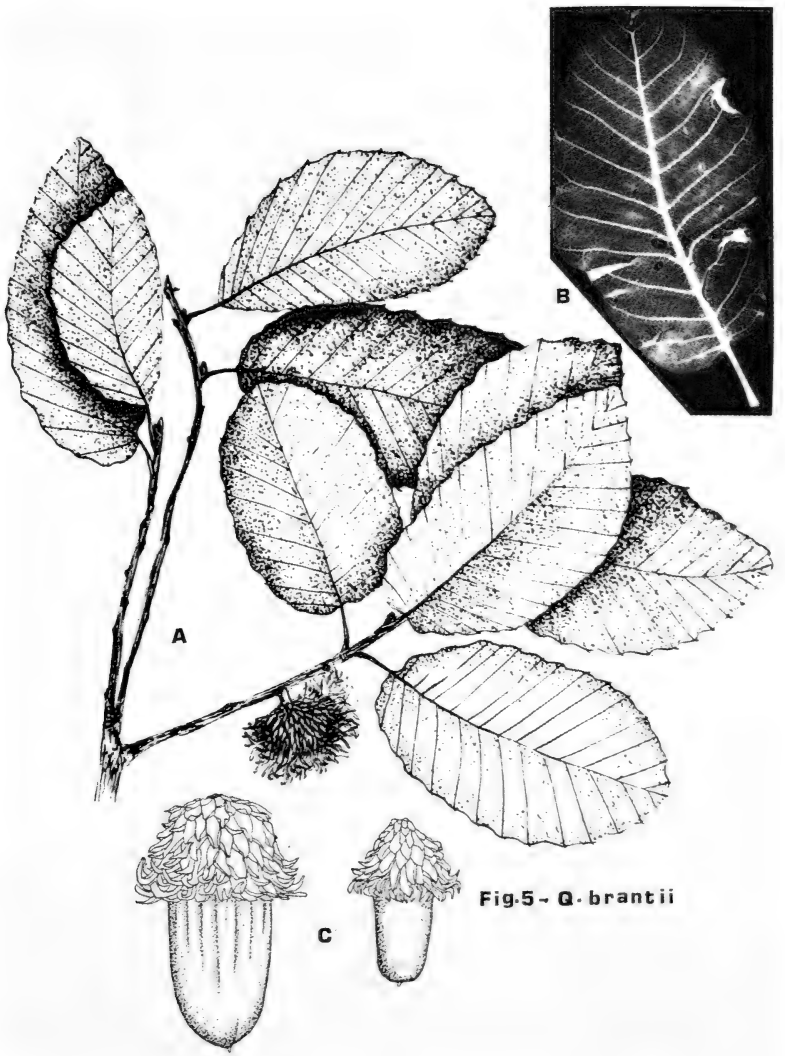


Fig.5 - Q. brantii

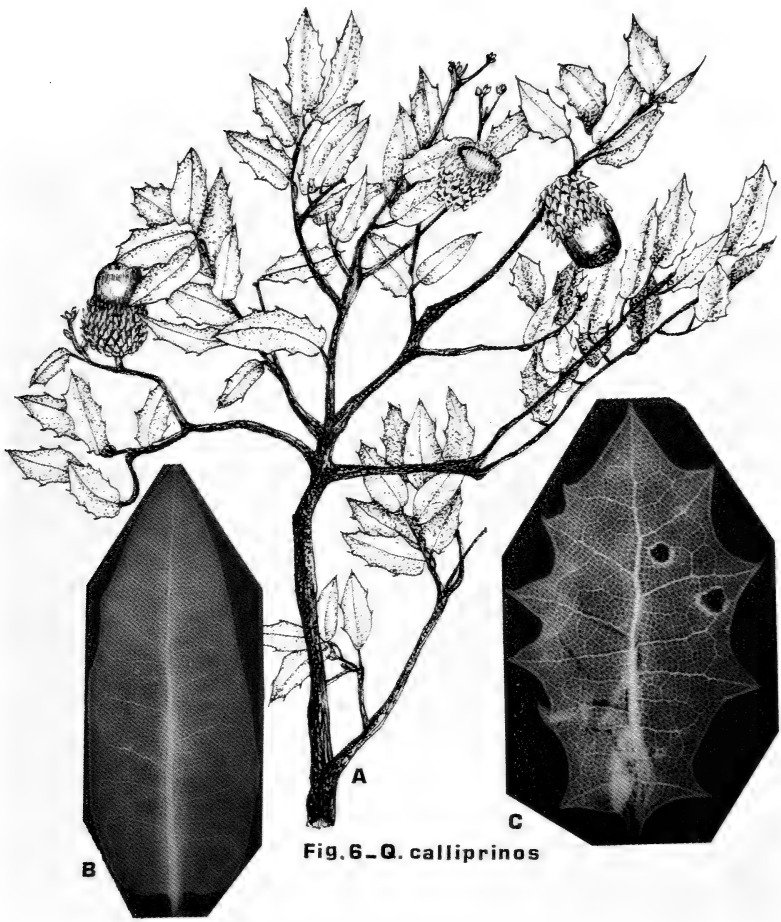


Fig. 6–Q. calliprinos

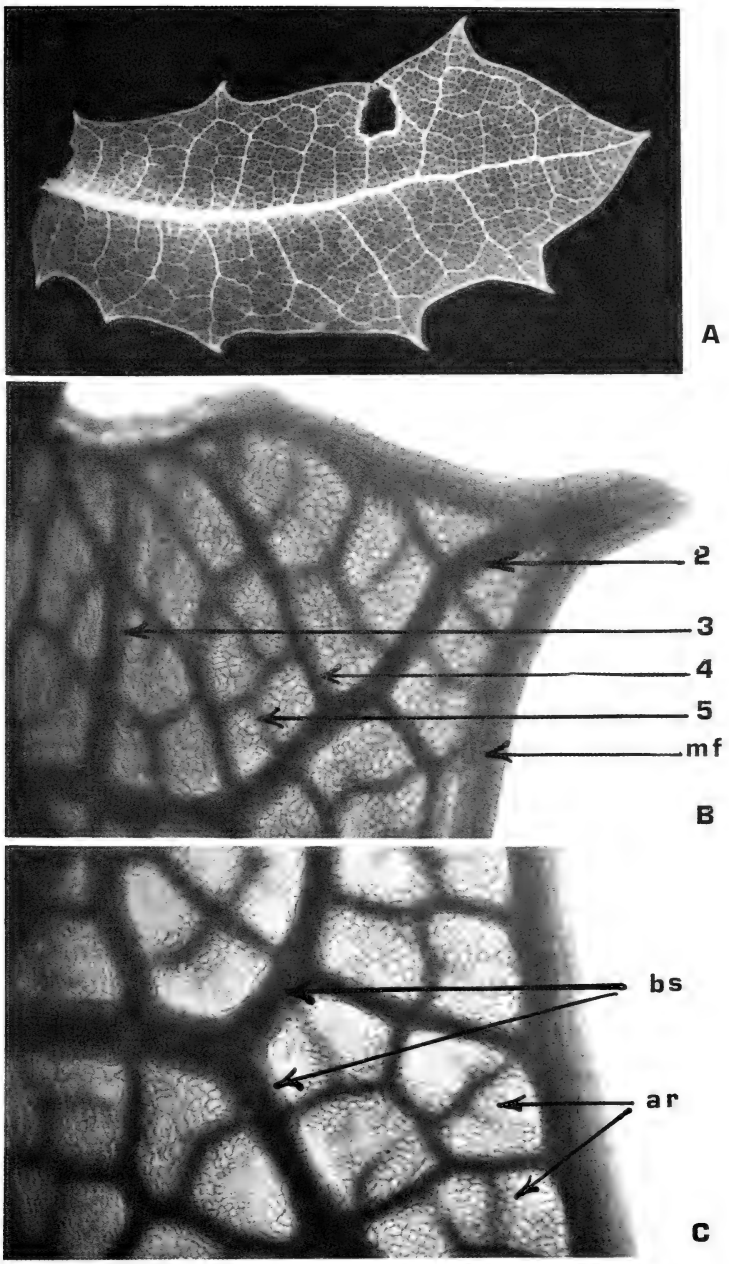


Fig. 7- Foliar vasculation of Quercus calliprinos.

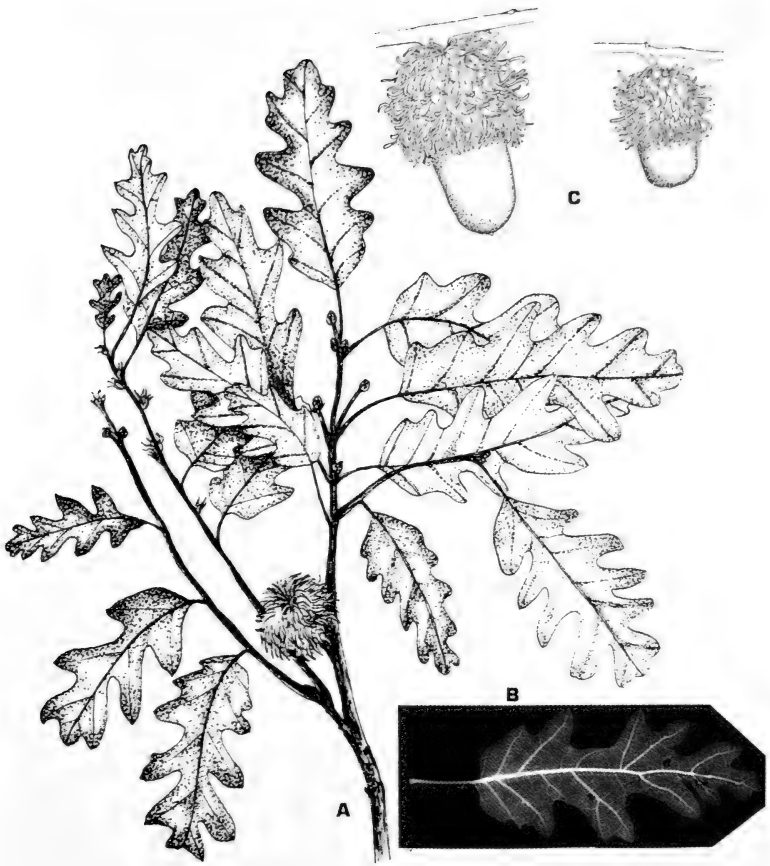


Fig.8- Q.cerris

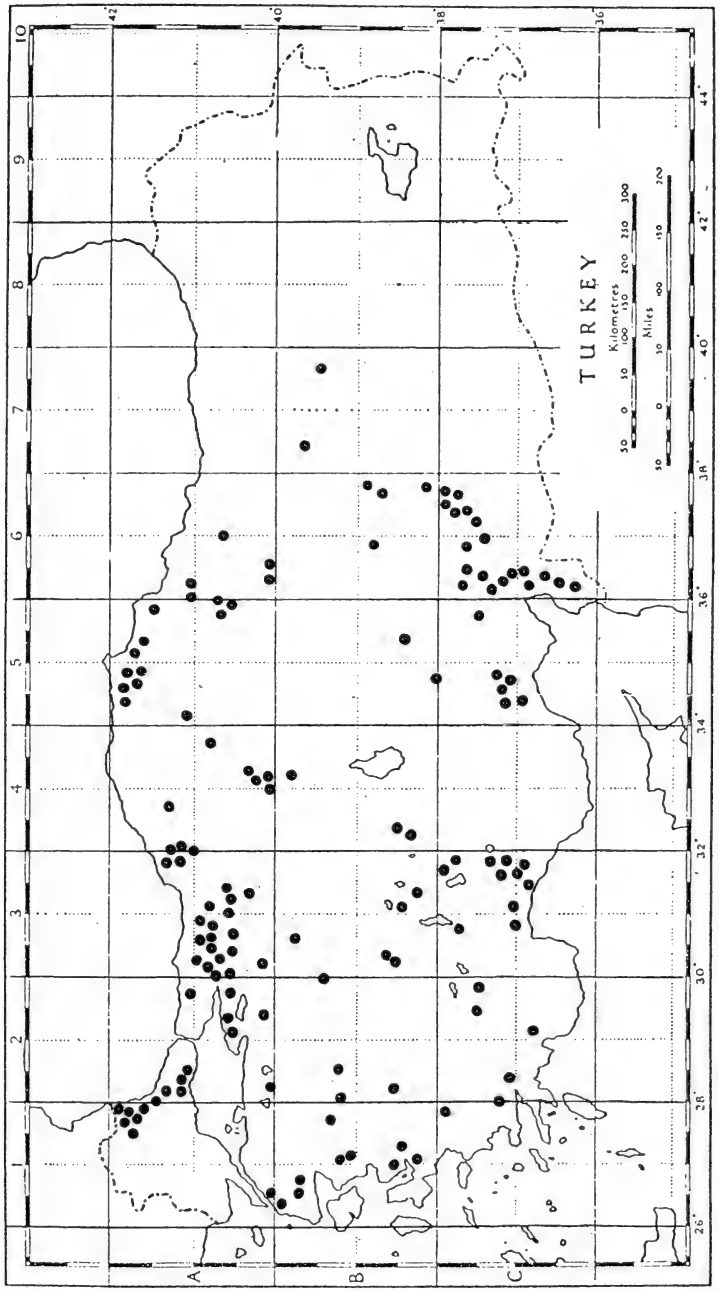
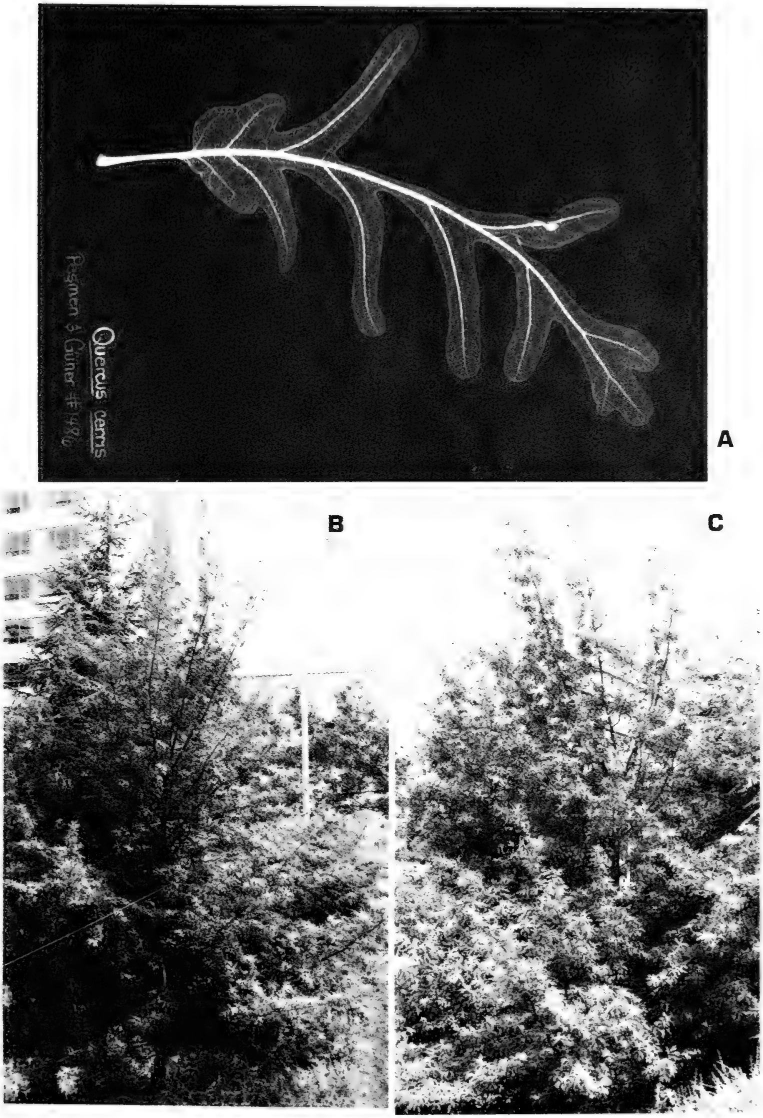


Fig. 9- Distribution of Quercus cerris in Turkey (•) .


Quercus cerris
A
B
C

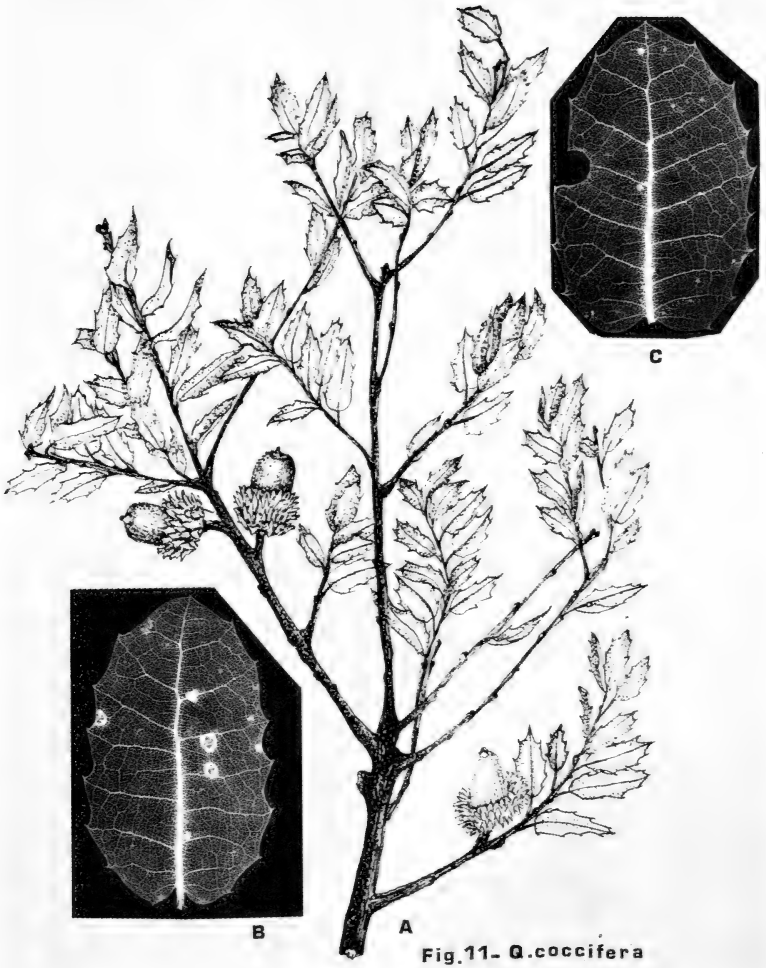


Fig.11- Q.coccifera

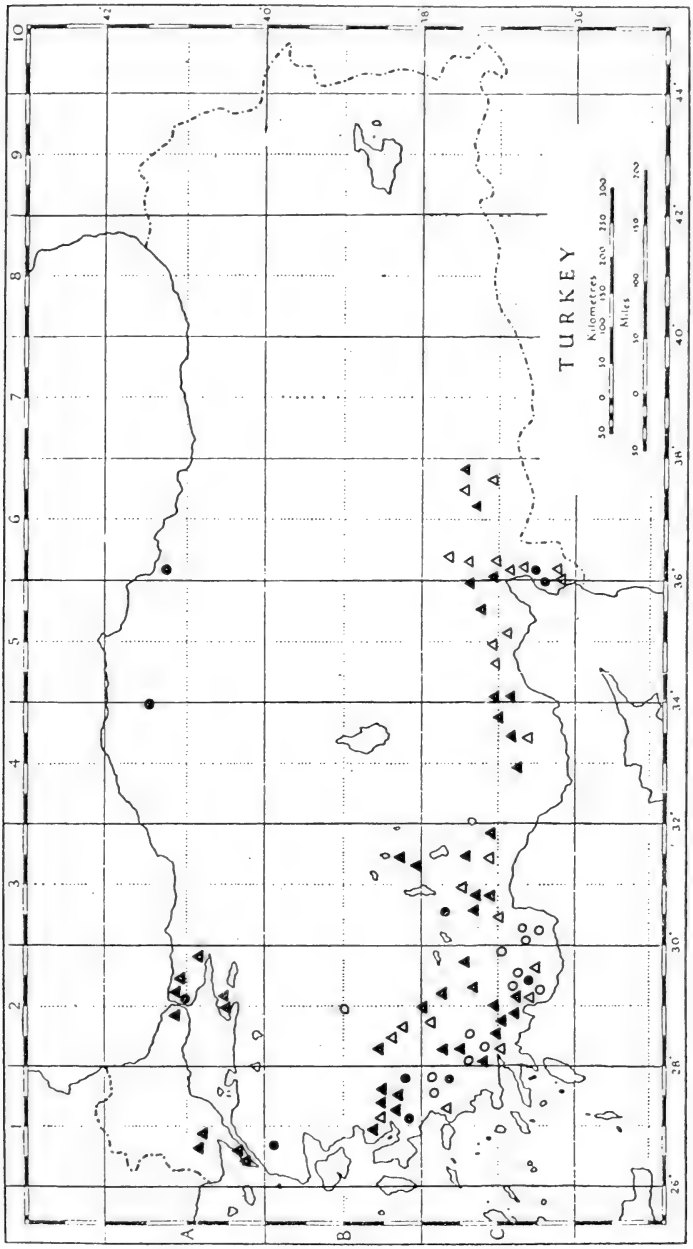


Fig.12- The distributions of Quercus aucheri Jaub.et Spach (○), Q. calliprinos Webb.(▲), Q. coccifera L. (△) and Q. ilex L.(●).

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CERTAMEN MELASTOMATACEIS XXXIII.

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With this installment of novelties, all of the easy taxonomic decisions have been completed in the outpouring of recent collections from Bahia, Brazil. However, much more work is needed, particularly in Microlicia, to present a reasonable treatment of the Melastomataceae for this still poorly known region.

LAVOISIERA HARLEYI Wurdack, sp. nov.

L. nervulosae Naud. affinis, foliis 3-5-nervatis non reticulato-venosis stylo glabro differt.

Ramuli primum tetragoni demum teretes primum sicut folia sparsiuscule glanduloso-setosi (pilis 1-2 mm longis) demum glabrati; nodi dense glanduloso-setulosi (0.2-0.3 mm). Folia sessilia imbricata; lamina 20-35 X 10-20 mm elliptico-oblonga apice rotundato basi late acuta vel obtusa, firmula et essentialiter integra, ad margines cartilaginea et glanduloso-ciliata, 3-5-nervata nervis secundariis nervulisque invisis. Flores 6-meri; hypanthium (ad torum) 10 mm longum usque ad medium densiuscule glanduloso-setosum (pilis ca 1.5 mm longis); calycis tubus ca 1 mm longus, lobis ca 3 mm longis basaliter expansis extus sparse glanduloso-setosis glanduloso-ciliolatis intus glabris. Petala 34-35 X 16-19.5 mm ad margines apicem versus modice glandulosa (0.1 mm) extus ad basim sparsissime glandulosa alioqui glabra. Stamina dimorphica glabra; filamenta 13-13.5 mm vel 11.5-12 mm longa; connectivum 10 mm vel 3 mm prolongatum ventraliter ad basim in appendice 3 X 1 X 1 mm vel 2 X 0.8 X 0.8 mm hebeti productum. Stylus 12.5 X 1.3-0.4 mm glaber; ovarium 6(?)-loculare apice glabro leviter intruso.

Type Collection: R. M. Harley 19690 (holotype CEPEC 19692; isotypes K, US), collected on northeast face of summit ridge, Pico das Almas ca 25 km WNW of the Vila do Rio de Contas, Bahia, Brazil, elev. 1600-1800 m, 19 March 1977. "Bushy shrub to 2 m. Leaves viscid, rather bright green. Petals bright pinkish magenta. Anthers golden-yellow."

Paratype (topotypical, fruiting): Mori 12455 (CEPEC, US).

The suggested relative (isotype US) has leaves 7-9-nerved (at the base) and markedly reticulate-venose beneath, as well as somewhat longer calyx lobes and basally glandular-setulose style. Of the other species in this affinity with moderate-sized leaves, L. selloana Cogn. differs (ex descr.) at least in the much smaller flowers and glabrous hypanthia, while L. cogniauxiana Mello Barreto (ex descr. and photo) has larger 9-nerved leaves and 8-merous flowers. To L. nervulosa, I have referred (with some reservations) two collections (Mori 12551, Harley 18788)

from just south of Mucujê; both have sparser pubescence than Blanchet 3333 and petals yellow with the exposed part externally red in bud (rather than wholly pink). All of the examinable flowers and fruit of L. harleyi were 6-merous; the anther thecae were all insect-destroyed.

MICROLICIA HATSCHBACHII Wurdack, sp. nov.

M. balsamiferae (DC.) Mart. affinis, ramulis setulosis staminum maiorum connectivis plus prolongatis differt.

Ramuli primum obscure tetragoni mox teretes modice vel densiuscule et subpersistenter glanduloso-setulosi pilis 0.2-0.4 mm longis. Petioli 0.5-1 mm longi subtus sparsiuscule glanduloso-setulosi; lamina (0.7-)1-1.5 X (0.4-)0.6-0.8 cm elliptica apice hebeti-acuto basi acuta, rigida et integra, ubique dense glanduloso-punctata, supra glabra, subtus glabra vel secus costam basim versus decidue glanduloso-setulosa, eciliata, 3-nervata. Flores in ramulis terminales 1-3, pedicellis ca 2 mm longis sicut hypanthiis basim versus sparse glanduloso-setulosis. Hypanthium (ad torum) 4.5-5.5 mm longum teres glutinosum; calycis tubus 1.3-1.5 mm longus, lobis 1.8-2 X 2.4-2.8 mm deltoideis hebeti-acutis. Petala glabra 16-17 X 9-13 mm asymmetrice obovata apice late obtuso. Stamina paulo dimorphica, filamentis 6-7.3 mm vel 6-6.5 mm longis, antherarum rostris obscure (0.5 mm) evolutis. Stamina maiora: thecae 4.4-6 X 0.8 X 1.1 mm; connectivum 1.8-2.5 mm prolongatum, appendice ventrali 0.6-0.7 mm longa hebeti. Stamina minora: thecae 4-5.3 X 0.7 X 1 mm; connectivum 0.9-1.5 mm prolongatum, appendice ventrali 0.4-0.5 mm longa hebeti. Stigma non expansum; stylus 8.5-12 X 0.5-0.2 mm in ovarii apicem 0.4-0.5 mm immersus; ovarium 3-loculare glabrum apice rotundato-lobulato. Semina 0.7 X 0.4 mm areolata.

Type Collection: G. Hatschbach 39696 (holotype MBM 48802; isotype US), collected at Rio Agreste, Mun. Morro do Chapéu, Bahia, Brazil, 17 Jan. 1977. "Arbusto muito ramoso, 1 m 70, flor rosada. Solo arenoso, junto a afloramentos de arenito."

Paratypes (all Morro do Chapéu region, Bahia, Brazil): Hatschbach & O. Guimaraes 42423 (MBM, US), Rodovia BA-052 8 km from Morro do Chapéu, elev. 900 m ("Arbusto ramoso, copado, 70 cm, flor rosada"); Hatschbach 39637 (MBM, US) ("Arbusto muito ramoso, 2 m, encosta de morro. Flor rosada"); Harley 19185 (CEPEC, K, US), Rio do Ferro Doido on BA-052 highway to Mundo Novo, 19.5 km SE of Morro do Chapéu, elev. 900 m ("Bushy shrub to 2 m with stems bare below. Leaves rigid, spreading, mid-green, slightly paler below. Sepals yellow green. Petals bright magenta. Anthers dark golden yellow. Stigma yellow with pinkish style"); Irwin, Harley, & Smith 32246 (US), Serra do Tombador 18 km E of Morro do Chapeu, elev. 1100 m ("Brittle ramose shrub ca 1.5 m tall. Corolla magenta; filaments red-violet; anthers yellow"); E. Pereira 2131 (RB, US), elev. 1000 m ("Arbusto de fl. roxas"); Davidse, Ramamoorthy, & Vital 11896 (MO), 19 km E of Morro do Chapéu, elev. 900 m ("Shrub 70 cm tall; petals reddish purple; leaves sticky").

Microlicia balsamifera is glabrous, with costulate

(especially basally) hypanthia, longer (ca 1.5 mm) anther rostra, and large stamen connectives prolonged only 1-1.5 mm; recent collections include Harley 15127, 15138, and 15423, all from the region north of Rio de Contas, Bahia. Other glabrous relatives include M. sincorensis (DC.) Mart., as well as perhaps M. blanchetiana (Naud.) Cogn. and M. crebropunctata Pilger. Among the pubescent species in Cogniaux' monograph, M. hatschbachii would perhaps key to near M. baccharoides Naud., which however has denser eglandular stem pubescence, leaf blades obtuse to rounded at the base, calyx lobes remote and subulate, and prolongation of the large stamen connectives 8-9 mm; recent materials referred by me to M. baccharoides include Harley 15901 and three Mori collections (12581, 12589, 12631), all from south of Mucujê, Bahia.

MICROLICIA HARLEYI Wurdack, sp. nov.

M. pallidae Cogn. et M. insigni Cham. affinis, foliis latioribus calycis lobis glanduloso-ciliatis petalis amplioribus differt.

Ramuli quadrangulati subtetrapteri glabri. Folia ascendentia sessilia rigida essentialiter epunctata ciliolato-subserrulata (ciliis 0.5-0.8 mm longis subappressis in foliis floralibus glanduliferis in foliis inferioribus eglandulosis) ad apicem 0.5-0.8 mm pungentia alioqui glabra apice acuto base late acuta; folia inferiora 15-20 X 5-8 mm oblongo-elliptica 3-5-nervata; folia superiora 8-10 X 3-4 mm lanceata 3-nervata. Flores in ramulis foliosis terminales solitarii vel pauci; pedicelli ca 1 mm longi. Hypanthium (ad torum) 3 mm longum glabrum; calycis tubus ca 0.3 mm longus extus in torii zona modice glanduloso-setosus (setis ca 1.5 mm longis), lobis 6 X 1.8-2 mm oblongo-lanceatis ad basim contiguis ciliolato-serrulatis (ciliis glanduliferis ca 1 mm longis) ad apicem 1-1.2 mm pungentibus alioqui glabris. Petala 16-17 X 8-9 mm oblongo-obovata apice late acuto et setula caduce glandulifera terminato alioqui glabra. Stamina dimorphica glabra, filamentis 5 mm longis, antheris oblongis 0.2-0.3 mm rostratis poro 0.2 mm diam. ventraliter inclinato. Stamina maiora: thecae 3.3 X 0.7-0.8 mm; connectivum 7-7.5 mm prolongatum et ultra filamenti insertionem 1.5 mm porrectum incrassatum hebes. Stamina minora: thecae 2.3 mm longae; connectivum 2 mm prolongatum et ultra filamenti insertionem 0.3 mm porrectum non incrassatum hebes. Stigma non expansum; stylus 9 X 0.4-0.1 mm glaber; ovarium ca 2.5 mm longum glabrum 3-loculare.

Type Collection: R. M. Harley 19665 (holotype CEPEC 19690; isotypes K, US), collected in a marsh in the first caldera above the first escarpment, middle and upper northeast slopes of Pico das Almas ca 25 km WNW of the Vila do Rio de Contas, Bahia, Brazil, elev. 1600-1800 m, 19 March 1977. "Subshrub to 1 m. Petals magenta; anthers red."

Both suggested relatives have leaves up to 11 X 3.5 mm, eciliate calyx lobes, and petals up to 11 mm long.

PYRAMIA CAMBESSEDESIOIDES Wurdack, sp. nov.

A congeneribus foliis parvis fasciculatis hypanthiis glabris differt.

Ramuli obscure quadrangulati sicut petioli modice pilis pinoideis 0.1-0.2 mm longis setulosi. Folia plerumque ad nodos fasciculati; petioli 0.1-0.2 mm longi; lamina 0.5-1 X 0.1-0.3 cm oblonga apice hebeti-acuto vel obtuso vel rotundato basi late acuta vel obtusa, rigida et integra, supra glabra, subtus sparse pilis pinoideis 0.1 mm longis deciduis setulosa, 1-3-nervata nervis secundariis nervulisque invisis. Panicula 2-5 cm longa foliosa submultiflora; flores 5-6-meri, pedicellis 5-7 mm longis, bracteolis 0.8-1 mm longis oblongo-ovatis persistentibus ca 1-1.5 mm infra hypanthium insertis. Hypanthium (ad torum) 5-5.5 mm longum glabrum; calycis tubus 0.4-0.8 mm longus, lobis 0.6-0.8 mm longis ovatis extus valde carinatis; torus intus sparse glandulosus. Petala glabra eciliata 7.5-10.5 X 4.4-5.3 mm elliptico-oblonga apice acuto et apiculato. Stamina in dimensionibus paulo dimorphica; filamenta 5.8-7.4 mm vel 4.8-6 mm longa apicem versus glandulosa; antherae 5.7-6 X 0.8-1 mm vel 4.8-5.2 X 0.8-0.9 mm paulo subulatae, thecis ad basim ventraliter 0.2-0.3 mm prolongatis. Stylus 16-16.5 X 0.4 mm basim versus sparse glandulosus; ovarium 5(-6)-loculare apice modice glanduloso-setuloso (0.1-0.3 mm).

Type Collection: S. A. Mori, R. M. King, T. S. dos Santos, & J. L. Hage 12576 (holotype CEPEC 17835; isotype US), collected 3 km south of Mucujê, Municipio Mucujê, Bahia, Brazil, elev. 1000 m, 26 July 1979. "Arbusto 1,5 m. Calice verde, corola vermelha alaranjada, com uma mancha amarela nas bases das pétalas, estames completamente amarelos."

Paratypes (all Bahia, Brazil): Edmundo Pereira 2181 (US, RB), from between Palmeiras and Lençois ("Arbusto, pétalas com a metade superior cór de abobóra e a base e os estamas amarelo"); A. P. Duarte 9358 (Pereira 10071) (RB, US), from Lençois ("Arbusto 1 m, fl amarela e vermelha"); Mori & Benton 13195 (CEPEC, US), from between Andarai and Mucujê 2 km south of Igatu, elev. 800 m.

The three previously known species of Pyramia have non-fasciculate leaves with blades 0.7-3 cm wide, as well as densely puberulent hypanthia. The Bahia endemic suggests the evolutionary end of Pyramia towards Cambessedesia, the 5-6-celled ovaries being the technical character of the former genus; the pubescence qualitatively is like that in the Bahia variants of C. membranacea Gardn. and C. harleyi Wurdack (vide infra).

CAMBESSEDESIA HARLEYI Wurdack, sp. nov.

C. membranaceae Gardn. affinis, petalis glanduloso-ciliolatis differt.

Ramuli primum rotundato-quadrangulati demum teretes sicut inflorescentia hypanthiaque modice glanduloso-setuloso (pilis plerumque 0.2-0.5 mm longis ad basim imperspicue papillosis) et sicut laminarum subtus venae primariae petiolique modice vel densiuscule setulosi (pilis asperis eglandulosis ca 0.2-0.3 mm

longis). Petioli 0.2-0.5 cm longi; lamina (1-)1.5-2.5(-3) X 1-2(-3.5) cm ovato-suborbicularis apice rotundato basi paulo (usque ad 0.5 cm) cordata, subrigida et distincte irregulariterque crenato-serrulata, supra glabra et dense bullata, subtus foveolata et in venulis superficieque modice pilis asperis 0.2-0.3 mm longis setulosa, 5(-7)-nervata nervis exterioribus usque ad basim liberis vel paulo (ad 2 mm) coalitis. Panicula 3-7 cm longa foliolosa submultiflora; flores 5-meri, pedicellis plerumque ca 2 mm longis, bracteolís ca 1-1.5 X 1-1.5 mm suborbicularibus vel ovatis persistentibus. Hypanthium (ad torum) 6 mm longum paullulo costulatum; calycis tubus 0.5-0.6 mm longus, lobis 0.5-0.6 mm longis late ovatis paullulo hebeti-apiculatis; torus intus inconspicue glanduloso-puberulus (0.1 mm). Petala 5.7-6.5 X 3.7-4.5 mm elliptico-ovata apice hebeti-acuto apicem versus crenulata et glanduloso-ciliolata (0.3-0.4 mm) alioqui glabra. Stamina in dimensionibus paulo dimorphica; filamenta 10-10.5 mm vel 7.5-8 mm longa inconspicue glanduloso-puberula; antherae 6.5 X 1 mm vel 4.6 X 0.7 mm oblongo-subulatae, thecis ad basim ventraliter 0.2-0.3 mm prolongatis, poro 0.15-0.2 mm diam. ventraliter inclinato. Stigma punctiforme; stylus 20 X 0.4 mm basim versus glanduloso-puberulus; ovarium 3-loculare inconspicue glanduloso-puberulum.

Type Collection: R. M. Harley 19189 (holotype CEPEC 19687; isotypes K, US), collected at Rio do Ferro Doido southeast of Morro do Chapéu on BA 052 highway to Mundo Novo, Bahia, Brazil, elev. ca 900 m, 1 March 1977. "Subshrub to 1.5 m. Leaves strongly and finely bullate, mid-green above, pale beneath. Calyx red-tinged. Petals bright vermilion with small yellow basal zone. Stamens golden-yellow."

Paratypes (all Bahia, Brazil): Harley 16692 (CEPEC, K, US), from Serra do Curral Feio 16 km northwest of Lagoinha (5.5 km southwest of Delfino) on road to Minas do Mimoso, alt. 950-1000 m ("Shrub to 1 m. Petals vermilion with yellow base. Anthers yellow"); Irwin, Harley, & Smith 32431 (NY, US), topotypical ("Slender brittle shrub to ca 1.5 m. Corolla red, yellow at base; stamens yellow"); Hatschbach 39609 (US), from Morro do Chapéu ("Subarbusto 60 cm, flor vermelha, estames centraes amarelos"); Davidse, Ramamoorthy, & Vital 11864 (MO), from Chapada da Diamantina 34 km east of Morro do Chapéu, elev. 910 m ("Shrub to 1 m; petals red; stamens and style yellow, turning orange in older flowers").

Cambessedesia membranacea has eciliate petals and (usually) glabrous stamen filaments and style; the type collection (NY) and Hatschbach 34127 (Serra Petrolina, M. Grosso) have leaf blades beneath glabrous and hypanthia nearly or quite glabrous. In Goias and Bahia, two variants of C. membranacea have been collected, both with the branchlet internodes and leaf blades beneath sparsely to moderately setulose with roughened hairs like those in C. harleyi. One of these variants, centered on Pico das Almas (Harley 19508 and 19609) and Serra do Rio de Contas (Harley 15161, Mori 12343), has glabrous hypanthia; the other variant, with glandular-setulose hypanthia, occurs in both

Goias (BR 354, Mineiros, Hatschbach 34255) and Bahia (Serra Agua de Rega, Irwin 30899; Serra Sincorá, Froes 20154, Harley 15585 and 15852). No material of C. eichleri Cogn. (Serra Caraça, Minas, fide Glaziou) has been seen, but from the description the much larger ovate acute leaves and eciliate petals are differences from C. harleyi. However, the puberulous variants above referred to C. membranacea should be compared with C. eichleri. The glandular-ciliolate corolla and glandular-puberulous filaments and style of C. harleyi are like those in C. weddellii Naud.; that Minas Gerais species, however, lacks roughened trichomes, having only smooth (and glandular) hairs.

CAMBESSEDESIA GRACILIS Wurdack, sp. nov.

C. tenui Markgraf affinis, foliis angustis esetulosis staminibus minoribus differt.

Ramuli primum obscure quadrangulati demum teretes glabri (in nodis obscure caduceque puberuli pilis ca 0.1 mm longis). Petioli 0.1-0.4 cm longi glabri; lamina (1-)2-3(-3.8) X (0.1)0.2-0.3 cm lineari-oblonga apice basique acuto, firme chartacea et integra vel apicem versus obscure distanterque serrulata, utrinque (glandulis paucis praecipue subtus exceptis) glabra, 1-3-nervata nervis secundariis nervulisque invisis. Flores 5-meri solitarii terminales, pedicellis ca 2 mm longis sparse glanduloSis. Hypanthium (ad torum) ca 4.5 mm longum modice glanduloso-setulosum (setulis 0.6-0.8 mm longis); calycis tubus ca 0.3 mm longus, lobis ca 1.2 mm longis ovatis extus carinatis. Petala sparse glanduloso-ciliolata (ciliis 0.1-0.2 mm longis) ca 6 X 4 mm elliptica apice obtuso et ca 0.3 mm apiculato. Filamenta 2.5-3 mm longa sicut stylus sparse glandulosa; antherae 4 vel 2.5 X 0.5 mm oblongae, thecis ventraliter ad basim 0.4-0.5 mm vel 0.1-0.2 mm protractis, poro minuto ventraliter inclinato. Ovarium 3-loculare apice modice glanduloso-setuloso (0.2-0.4 mm).

Type Collection: S. A. Mori, R. M. King, T. S. dos Santos, & J. L. Hage 12533 (holotype CEPEC 16969; isotype US), collected on Pico das Almas 18 km from Rio de Contas, Bahia, Brazil, elev. 1300-1400 m, 24 July 1979. "Subarbusto. Cálice verde, o restante da flor amarela."

Paratype: Mori & Benton 13574 (CEPEC, NY), near-topotypical, elev. 1200 m. "Subarbusto 50 cm de altura Cálice verde con pelos avermelhados, corola e estames amarelos."

The suggested relative has sparsely glandular-setulose branchlets, lower leaf surfaces, and leaf margins, much wider oval leaves (1-2.5 cm wide) and large anthers 6-6.5 mm long. Cambessedesia hilariana (Kunth) DC. var. longifolia Cogn. has leaves rather like those of C. gracilis and glandular-ciliolate petals, but the leaves are fascicled, the branchlet nodes distinctly villosulous, and the large anthers much longer; the variety is perhaps specifically distinct from typical C. hilariana and has both filaments and style sparsely glandular-puberulous basally (a feature also true to some extent in other varieties).

MARCETIA SINCORENSIS Wurdack, sp. nov.

M. nervulosae Markgraf affinis, ramulis (nodis exceptis) esetulosis, foliis ad apicem acutis nervulis subtus ob indumentum subamorphum occultis differt.

Ramuli quadrangulati modice resinoso-granulosi esetosi (nodis exceptis); nodi obscure caduceque glanduloso-setulosi pilis 0.1-0.2 mm longis. Folia essentialiter sessilia, petiolis vix 0.5 mm longis; lamina (8-)10-18 X (5-)7-9(-13) mm ovata vel oblongo-ovata apice acuto basi rotundato-truncata, rigida, supra primum sparse resinoso-glandulosa mox glabrata, subtus dense resinoso-granulosa, (7-)9-nervata nervulis subtus paulo denseque elevato-reticulatis ob indumentum obscuris. Flores in foliorum superiorum axillis oppositis solitarii (in cyma pauciflora foliosa 2-3 cm longa aggregati); pedicelli 1-2 mm longi, bracteolis ca 3 X 0.7 mm persistentibus. Hypanthium (ad torum) 6.5 mm longum sparsiuscule resinoso-granulosum esetulosum; calycis tubus 0.4 mm longus, lobis 3-3.5 X ca 0.7 mm subulatis remotis. Petala 7.5-8 X 5 mm elliptica (apice acuto) minute (0.05 mm) glanduloso-ciliolata alioqui glabra. Stamina isomorphica glabra; filamenta 6.5 mm longa; thecae 6.5-6.6 X 1 X 1 mm oblongo-subulatae, poro 0.15 mm diam. ventraliter inclinato, connectivo ad basim paulo incrassato. Stigma punctiforme; stylus 12.5 X 0.5-0.1 mm glaber; ovarium 4-loculare glabrum.

Type Collection: R. M. Harley 18855 (holotype CEPEC 19249; isotypes K, US), collected 10-15 km north of Mucujê on road to Andaraí, Serra do Sincorá, Bahia, Brazil, elev. ca 1100 m, 18 Feb. 1977. "Shrub to 1.5 m. Leaves grey, paler beneath. Petals white. Stamens with showy yellow anthers and white filaments."

Paratypes: Mori, King, dos Santos, & Hage 12657 (CEPEC, US; "Arbusto 1,5 m de altura. Corola branca, filetes e estilete brancos.") and 12666 (CEPEC, US; fruiting), both from 10-12 km northwest of Mucujê on road to Andaraí, Bahia, Brazil, elev. 1000 m.

Marcetia nervulosa has branchlet internodes densely setulose with rather robust caducously gland-tipped hairs, leaves with obtuse to rounded apices and with the nervules beneath obvious and moderately setulose with gland-tipped hairs 0.1-0.3 mm long, and hypanthia definitely (but rather sparsely) setulose with gland-tipped hairs 0.1-0.3 mm long. While the petals of M. nervulosa were thought by Markgraf to be yellow, this may well have been a drying artifact. The only recent collection seen of M. nervulosa is Mori 12915 (Pai Inácio ca. 15 km NE of Palmeiras, Mun. Palmeiras, Bahia, elev. 1000-1200 m), fruiting.

MARCETIA MACROPHYLLA Wurdack, sp. nov.

M. grandiflorae Markgraf affinis, ramulorum pubescentia longiore petalis angustioribus antheris paulo subulatis differt.

Ramuli quadrangulati dense setosi pilis gracilibus ca 3-4 mm longis eglandulosis pilis glanduliferis ca 1 mm longis modice intermixtis. Folia essentialiter sessilia, petiolis ca 1-1.5 mm longis; lamina plerumque 2.5-4 X 1.5-2(-2.5) cm oblongo-elliptica

apice obtuse rotundato basi paullulo (1-2 mm) cordata, rigida, supra dense subsericeo-strigosa pilis gracilibus eglandulosis ca 2 mm longis, subtus dense appresso-setosa pilis gracilibus ca 2 mm longis pilis glanduliferis ca 0.1 mm longis inconspicue intermixtis, (7-)9(-11)-nervata nervulis subtus crebro elevato-reticulatis ob pilos occultis. Panicula foliosa 2-4 cm longa pauciflora; pedicelli plerumque 4-6 mm longi sicut hypanthia (extus) et sepala (ubique) densiuscule setosi pilis gracilibus 1-2 mm longis pro parte glanduliferis. Hypanthium (ad torum) 6-7.5 mm longum; calycis tubus ca 0.2 mm longus, lobis 5.2-7 X 1-1.2 mm lanceatis. Petala 6.5-8 X 3.7-5 mm anguste ovata apice acuto et setula 0.5-0.7 mm longa terminato glanduloso-ciliolata et extus circum margines glanduloso-puberula. Stamina isomorphica glabra; filamenta 7.2-8 mm longa; antherae 7-7.5 X 0.9-1 mm paulo subulatae poro 0.15-0.2 mm diam. ventraliter inclinato; connectivum ad basim vix incrassatum. Stigma punctiforme; stylus 19-20 X 0.4-0.5 mm glaber; ovarium 4-loculare glabrum.

Type Collection: R. M. Harley 15986 (holotype CEPEC; isotypes K, US), collected near Rio Cumbuca ca 3 km north of Mucujê on Andaraí road, Serra do Sincorá, Bahia, Brazil, elev. ca 850 m, 5 Feb. 1974. "Shrub ca 1.5 m. Leaves dark green with impressed veins above, paler beneath. Calyx red. Petals magenta; stamens with white filaments and deep yellow anthers."

Paratypes (both Serra do Sincorá, Bahia): R. L. Froes 20236 (NY, US), from Mucujê; Harley 18667 (CEPEC, K, US), from south of Andaraí 16 km along Mucujê road near Xique-Xique, elev. 700-900 m. "Shrub to 3 m, with bright red-brown bark. Leaves spreading, rigid, dull green above, paler beneath. Calyx red; petals pale magenta. Stamens with golden-yellow anthers and pink filaments; style deep pink."

The suggested relative has stem pubescence 1-1.5 mm long, leaf blades 14-16 X 10-11 mm with 13 primary nerves, calyx lobes 10 mm long, petals 18 X 18 mm, and oblong anthers with a broad (0.3 mm) but slightly ventral pore. Another relative, M. velutina Markgraf, has short cauline pubescence like that of M. grandiflora, subrotund leaf blades 10-20 X 12-18 mm, calyx lobes only ca 3 mm long, and anther pore dorsally inclined (and anthers shaped as in M. macrophylla); two recent collections of this Bahia endemic are Harley 15164 (Serra do Rio de Contas) and Mori et al 12560 (Mucujê).

MARCETIA LANUGINOSA Wurdack, sp. nov.

M. nummulariae Markgraf affinis, foliorum subtus ramulorumque pubescentia arachnoideo-lanuginosa differt.

Ramuli quadrangulati sicut foliorum laminae subtus densissime arachnoideo-lanuginosi pilis eglandulosis. Folia sessilia; lamina (0.7-)1-1.3 X (0.5-)0.9-1.3 cm ovato-suborbicularis apice late obtuso vel rotundato basi paulo (1 mm) cordato-amplexicauli, rigida, supra modice strigulosa pilis eglandulosis robustis plerumque 0.5-0.7 mm longis, 5-7-nervata. Flores ad ramorum apices solitarii vel in inflorescentia foliosa usque ad 3 cm longa aggregati; pedicelli 1-2 mm longi sicut hypanthia dense

pilis gracillimis laxis et paulo crispulis minute glanduliferis 1.5-2 mm longis induti. Hypanthium (ad torum) 3.5-4 mm longum; calycis tubus 0.2 mm longus, lobis 3.5 X 0.8 mm anguste oblongis remotis ubique dense glanduloso-setulosis. Petala 8.5-11 X 7-7.7 mm oblongo-elliptica apice setula glandulifera 0.6-0.7 mm longa terminato glanduloso-ciliolata alioqui glabra. Stamina isomorphica glabra; filamenta 5.1-5.4 mm longa; antherae 5-5.5 X 0.8-0.9 mm, poro 0.15 mm diam. paulo ventraliter inclinato, connectivo ad basim paullulo incrassato. Stigma punctiforme; stylus 21.5 X 0.4 mm glaber; ovarium 4-loculare glabrum.

Type Collection: R. M. Harley 15828 (holotype CEPEC; isotypes K, US), collected ca 10 km north of Barra da Estiva by Rio Preto on Ibicoara road, Serra do Sincorá, Bahia, Brazil, elev. 1100 m, 2 Feb. 1974. "Subshrub 20 cm high. Flowers magenta."

Paratypes (all Bahia): Harley 15095 (CEPEC, K, US), from ca 6 km north of town of Rio de Contas on Abaira road, Serra do Rio de Contas, elev. 1000 m ("Brittle-stemmed decumbent shrub to ca 20 cm"); Harley 15714 (CEPEC, K, US), from north face of Serra de Ouro, 7 km south of Barra da Estiva on Ituacu road, Serra do Sincorá, elev. ca 1150 m ("Subshrub with magenta flowers"); Harley 20007 (CEPEC, K, US), from ca 5 km east of Vila do Rio de Contas on Marcolina Moura road, Serra do Rio de Contas, elev. 1000 m ("Erect shrublet with single stems to 10 cm high. Stem and underside of leaves white-woolly. Leaves above dark green, with white appressed hairs. Calyx lobes maroon; petals brilliant mauve; filaments white; anthers lemon yellow; style magenta"); King & Bishop 8613 (UB, US), from 16 km north of Livramento do Brumado along road to Arapiranga, elev. 900 m ("Corolla magenta").

Marcetia nummularia has leaves of similar shape but stems and primary leaf veins beneath with discrete erect setulae. Evidently Markgraf's floral dimensions were taken from a bud (packet on Luetzelburg 175, M) and there are now only fruit visible on the specimen branches; the petals are probably larger than 2 mm.

MARCETIA VISCIDA Wurdack, sp. nov.

M. sincorensi Wurdack affinis, foliis distincte petiolatis laminis ad basim acutis calycis lobis pedicellisque longioribus differt.

Ramuli obscure quadrangulati sicut pedicelli calycis lobi hypanthiaque glabri. Petioli 1.5-2.5 mm longi; lamina 12-24 X 4-6 mm lanceata vel oblongo-lanceata apice hebeti-acuto basi late acuta, subrigida, supra glabra, subtus densiuscule arachnoideo-furfuracea, (5-)7-nervata nervulis subtus ob indumentum occultis. Flores in foliorum superiorem axillis oppositis singuli, pedicellis ca 5 mm longis, bracteolis 3-5 X 0.6-1 mm persistentibus. Hypanthium (ad torum) 4.5 mm longum; calycis tubus 0.3 mm longus, lobis 6.3-6.6 X 1.1-1.2 mm oblongis remotis apice rotundato; torus intus sparse glanduloso-setulosus. Petala 12 X 8-8.2 mm elliptica (apice late acuto vel obtuso) minute glanduloso-ciliolata. Stamina isomorphica glabra; filamenta 4 mm

longa; antherae 4.5-4.8 X 0.7-0.8 X 0.7 mm oblongae poro 0.2 mm diam. ventraliter inclinato, connectivo ad basim ventraliter bilobulato-incrassato. Stigma punctiforme; stylus 6.6 X 0.4 mm sparse glandulosus; ovarium semper 4-loculare glabrum.

Type Collection: R. M. Harley 15162 (holotype CEPEC; isotypes K, US), collected 12-14 km north of town of Rio de Contas on road to Mato Grosso, Serra do Rio de Contas, Bahia, Brazil, elev. ca 1200 m, 17 Jan. 1974. "Viscid wiry subshrub to ca 35 cm. Petals white or cream."

Paratype: Harley 20149 (K), collected 2.5-5 km south of Vila do Rio de Contas, Bahia, Brazil, elev. ca 980 m. "Spindly shrub to ca 75 cm with bare stems and leaves mainly fallen. Leaves rigid, dull dark green, paler beneath. Calyx red-tinged, very viscid. Petals white; anthers yellow; filaments white."

Marcetia sincorensis has essentially sessile and thicker leaves with rounded-truncate base, pedicels 1-2 mm long, subulate calyx lobes 3-3.5 mm long, and petals 7.5-8 X 5 mm, as well as more subulate anthers with less distinct ventro-basal connective thickening.

MARCETIA FORMOSA Wurdack, sp. nov.

M. viscidae Wurdack affinis, foliis 9-nervatis floribus maioribus petalis magentis differt.

Ramuli rotundato-quadrangulati sicut foliorum venae primariae subtus hypanthiaque densiuscule caduceque resinoso-granulosi esetosi. Petioli 2-2.5 mm longi crassi; lamina 20-30 X 6-12 mm oblongo-elliptica apice hebeti-obtuso basi late acuta, rigida, supra primum modice resinoso-granulosa glabrata, subtus in superficie dense arachnoideo-furfuracea, 9-nervata. Flores in foliorum superiorem axillis oppositis solitarii, pedicellis 10-12 mm longis, bracteolis non visis. Hypanthium (ad torum) 6.5 mm longum paulo obtuseque 8-costatum; calycis tubus 0.5 mm longus, lobis 10.5-11 X 2 mm (apice rotundato); torus intus dense glanduloso-ciliatus pilis gracillimis 2.5-2.7 mm longis. Petala 24-25 X 20-21 mm minute (0.05 mm) glanduloso-ciliolata alioqui glabra. Stamina isomorphica glabra; filamenta 6 mm longa; antherae 5-5.5 X 1.6-2 X 1.5 mm oblongae, poro 0.3 mm diam. ventraliter inclinato, connectivo ad basim dorsaliter incrassato. Stigma punctiforme; stylus 10 X 0.35 mm glaber; ovarium 4-loculare glabrum.

Type Collection: R. M. Harley 15452 (holotype CEPEC; isotypes K, US), collected on slopes of Pico das Almas ca 25 km WNW of Rio de Contas, Bahia, Brazil, elev. ca 1600 m, 23 Jan. 1974. "Wiry shrub to ca 1 m with leaves very dark green above, greyish beneath. Calyx viscid. Petals deep very bright magenta."

Both species share the feature of the torus being glandular-puberulous within. Certainly M. formosa has the largest flowers now known in the genus.

MARCETIA HARLEYI Wurdack, sp. nov.

M. sincorensi Wurdack affinis, foliis floribusque minoribus ovario 3-loculari differt.

Ramuli obscure tetragoni sicut folia subtus calycis lobi (intus et extus) hypanthiaque dense furfuracei indumento ut videtur subamorpho sed magnificatione maxima glanduloso. Folia essentialiter sessilia (petiolis crassis obscuris ca 0.3 mm longis) 5-8(-11) X 2-5 mm oblongo-elliptica apice hebeti-acuto vel obtuso basi late acuta, rigida, supra glabra, 5-7(-9)-nervata nervulis on indumentum occultis. Flores in foliorum superiorem axillis oppositis solitarii, pedicellis ca 2 mm longis, bracteolis 2-2.5 X 0.8-1 mm persistentibus. Hypanthium (ad torum) 3 mm longum obscure 8-costatum; calycis tubus 1.2-1.5 mm longus, lobis 2.4-2.5 X 1.5 mm ovato-oblongis obtusis remotis, appendicibus intercalycinis non evolutis. Petala 8-9.5 X 7.5-9.5 mm late obovata (apice rotundato) minutissime glanduloso-ciliolata alioqui glabra. Stamina isomorphica glabra; filamenta 4 mm longa; thecae 2.7-2.9 X 0.9-1 X 0.8-1 mm lanceatae, poro 0.15 mm diam. ventraliter inclinato, connectivo ad basim paulo incrassato. Stigma punctiforme; stylus ca 5 X 0.35-0.4 mm glaber; ovarium semper 3-loculare glabrum.

Type Collection: R. M. Harley 15698 (holotype CEPEC; isotypes K, US), collected on north slope of Serra de Ouro 7 km south of Barra da Estiva on Ituacu road, Serra do Sincorá, Bahia, Brazil, elev. ca 1150 m, 30 Jan. 1974. "Subshrub 20 cm high. Flowers magenta."

Paratypes (all Bahia, Brazil): Harley 15518 (CEPEC, K, US), from 6 km north of Barra da Estiva on Ibicoara road, Serra do Sincorá, elev. 1100 m ("Wiry shrub to ca 50 cm. Leaves glossy, dull green above, grey beneath. Calyx red; petals magenta; filaments white; anthers bright yellow"); Harley 15841 (CEPEC, K, US), from 14 km north of Barra da Estiva near Ibicoara road, Serra do Sincorá, elev. 1100 m ("Wiry subshrub to ca 20 cm. Leaves dark green above, grey beneath. Petals magenta; anthers yellow"); Harley 15094 (CEPEC, K, US), from 6 km north of Rio de Contas on Abaira road, Serra do Rio de Contas ("Wiry subshrub to ca 20 cm. Leaves dull green. Petals bright magenta; stamens orange-yellow"); Irwin, Harley, & Smith 31075 (NY, US), from 24 km north of Seabra on road to Agua de Rega, Serra da Agua de Rega, elev. ca 1000 m ("Subshrub to ca 40 cm tall. Corolla rose-pink, aging to deeper pink"); Irwin, Harley, & Smith 32413 (NY, US), from Morro do Chapéu, Serra do Tombador, elev. 1125 m ("Subshrub ca 35 cm tall, from thick rootstalk. Corolla red-violet; filaments white; anthers yellow"); Hatschbach 39599 (US), from Morro do Chapéu ("Ereta 35 cm, flor purpurea, anteras e estames amarelos"); King & Bishop 8612 (UB, US), from 16 km north of Livramento do Brumado on road to Arapiranga, elev. 900 m ("Corolla magenta").

In qualitative foliar features, M. harleyi and M. sincorensis are quite compatible; however M. sincorensis has much larger flowers with acute petals. Technically the 3-celled ovary would remove M. harleyi from Sect. Marcetia, but the other species features (and lack of intersepalar appendages) do not suggest any close affinity with M. gracillima Cogn. and M. luetzelburgii Markgraf of Sect. Pseudomarcetia.

PTEROLEPIS HATSCHBACHII Wurdack, sp. nov.

P. weddellianae (Naud.) Triana affinis, floribus minoribus trimeris differt.

Suffrutex ut videtur ca 0.4 m superne ramosus; ramuli subalato-quadrangulati (alis ca 0.1 mm altis modice strigulosis pilis ad basim non productis) inter alas glabri. Petioli ca 0.5 mm longi crassi; lamina 1-2.5 X 0.4-0.8 cm lanceata apice acuto basi obtusa, chartacea et essentialiter integra appresso-ciliolata, supra sparsiuscule strigosa (pilis gracilibus ca 0.8-1.3 mm longis ad basim ca 0.2 mm adnatis), subtus in superficie sparse strigulosa pilis 0.3-0.5 mm longis, trinervata nervis primariis lateralibus supra invisis. Flores fere semper 3-meri in axillis foliosis superioribus plerumque solitarii, pedicellis 1-1.5 mm longis. Hypanthium (ad torum) 4 mm longum sparse strigosum pilis omnibus simplicibus gracilibus eglandulosis 1-2 mm longis; calycis tubus 0.2 mm longus appendicum axibus 0.7-0.8 mm longis, lobis 5-5.2 X 2.2-2.4 mm oblongo-lanceatis ciliolatis seta terminali ca 2 mm longa alioqui glabris. Petala 10 X 10-11 mm late obovata apiculata seta terminali ca 2 mm longa excepta glabra. Stamina in dimensionibus paullulo dimorphica glabra; filamenta 5.5 mm vel 4.8 mm longa; thecae 3.9-4 X 0.6 mm vel 3.4 X 0.5 mm subulatae, poro 0.15 mm diam. ventraliter inclinato; connectivum non prolongatum, lobis ventralibus incrassatis ca 0.4-0.5 X 0.5-0.6 mm. Stigma non expansum; stylus 11 X 0.4-0.15 mm glaber; ovarium 3-loculare pilis apicalibus 0.2-0.7 mm longis pro parte glanduliferis.

Type Collection: G. Hatschbach & O. Guimarães 42363 (holotype MBM 62898; isotype US), collected in moist sandy soil at Serra do Tombador, Mun. Morro do Chapéu, Bahia, Brazil, elev. 1050 m, 15 July 1979. "Flor lilas."

Pterolepis weddelliana has 4-merous flowers with the hypanthium plus calyx tube 6-7 mm long and equaled by the calyx lobes, as well as anthers ca 6 mm long and connective prolonged ca 0.5 mm; to P. weddelliana I have referred Woolston 906 (US, from Primavira, Alto Paraguay, Paraguay) and Steinbach 5151 (US, from Buena Vista, Prov. Sara, Depto. Santa Cruz, Bolivia, elev. 500 m). The other species placed by Cogniaux in this complex, P. repanda (DC.) Triana, has cauline pubescence on all sides (rather than confined to the angles), as well as larger flowers with longer stalks on the intersepalar hairs. I do not believe that the other trimerous species, P. trimera Ule, is closely related to P. hatschbachii (nor is the Sect. Trimerocalyx Ule natural). To P. trimera has been referred Hatschbach & Guimarães 42353, from Serra do Tombador, Bahia, elev. 1000 m, agreeing well with Ule's description (but with lilac petals); of the examinable flowers in this recent collection, 26 had 3 calyx lobes and 20 had 4 calyx lobes. All except 2 of the 42 examinable flowers or fruits in Hatschbach 42363 showed 3 sepals.

ADDITIONAL NOTES ON THE GENUS *PRIVA*. X

Harold N. Moldenke

PRIVA Adans.

Additional & emended bibliography: Brongn., Enum. Gen. Pl., ed. 1, 65. 1843; Walp., Repert. Bot. Syst. 6: 687. 1847; Brongn., Enum. Gen. Pl., ed. 2, 119. 1850; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 133, 137, 139, 142--144, 153, & 155, fig. 59 E. 1895; Mold., Phytologia 49: 58--64. 1981.

PRIVA ASPERA H.B.K.

Additional bibliography: Walp., Repert. Bot. Syst. 6: 687. 1847; Mold., Phytologia 49: 61. 1981.

PRIVA GRANDIFLORA (Ort.) Mold.

Additional bibliography: Mold., Phytologia 49: 63. 1981.

Miranda encountered this plant in pine woods and pedregal.

Additional citations: MEXICO: Distrito Federal: *Miranda 712* (Me--74094). México: *Miranda 449* (Me--94095).

PRIVA LAPPULACEA (L.) Pers.

Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 143. 1895; Mold., Phytologia 49: 61 & 63. 1981.

The *Cuatrecasas & Castañeda 25521* and *Proctor 3341*, distributed as typical *P. lappulacea*, actually represent f. *albiflora* Mold., while *Daniel 5639* (at least insofar as the United States National Herbarium specimen is concerned) is not verbenaceous.

Additional citations: NICARAGUA: Estelí: *W. D. Stevens 2603* (Ld), *9082* (Ld). León: *W. D. Stevens 4693* (Ld). Managua: *W. D. Stevens 2650* (Ld), *2895* (Ld), *3433* (Ld). Masaya: *Araquistain 234* (Ld); *Vincelli 772* (Ld). Matagalpa: *W. D. Stevens 9380* (Ld). Rivas: *W. D. Stevens 3777* (Ld). PANAMA: Panama: *Croat 34678* (W--2846392). COLOMBIA: Chocó: *Forero, Jaramillo, León, & Forero P. 1902* (N), VENEZUELA: Lara: *Steyermark & Espinoza 108774* (N). GALAPAGOS ISLANDS: Santa Cruz: *Fournier 207* (W--2853561). PERU: Madre de Díos: *Foster, Foster, Brokaw, & Brokaw 3307* (W--2888882). BRAZIL: Amazônas: *Lasseigne P.21182* (N).

PRIVA LAPPULACEA f. *ALBIFLORA* Mold.

Additional bibliography: Lopez-Palacios, Revist. Fac. Farm. Univ. Andes 20: 30. 1979; Mold., Phytologia 44: 98, 102, & 104--105. 1979; Mold., Phytol. Mem. 2: 50, 66, 74, 78, 79, 84, 101, 111, 118, 123, 129, 131, & 573. 1980.

Recent collectors refer to this plant as an herb with weak stems to 1 m. long, yellow anthers, and the fruit green with a fruiting-calyx easily attaching itself to the passerby, and have encountered it at the upper edge of a potrero as well as on wooded islets on slightly elevated ground in savannas "visited in part by cattle", in shade along roadsides, in coffee plantations,

on steep uncultivated slopes of soft volcanic rock, in weedy *Panicum maximum* pastures on neutral to slightly calcareous soil "of coluvial origin", and "occasional along stony paths", at 80--1050 m. altitude, flowering and fruiting in April and from September to November. The corollas are said to have been "white with purple lines" on *Hinton 17664* and "white, pink-veiny" on *Chrostowski 69-132*. The vernacular name, "yerba amarosa", is reported.

Material of this form has been misidentified and distributed in some herbaria as the typical form and also as *P. mexicana* (L.) Pers. Calderón reports the vernacular name, "cadillo de bolita".

Additional citations: MEXICO: Nuevo León: *Hinton 17664* (Au). Oaxaca: *Calderón 24* (Au, N). NICARAGUA: Estelí: *Stevens & Araquistain 14942* (Ld). Managua: *W. D. Stevens 3922* (Ld). NORTHERN SOUTH AMERICAN ISLANDS: San Andres: *Proctor 3341* (W--1979220). COLOMBIA: Guajira: *Cuatrecasas & Romero Castaneda 25521* (W-2342058). Magdalena: *Kirkbride 2528* (W--2835048). GUYANA: *Maas & Westra 4109* (Ld). PERU: San Martín: *Chrostowski 69-132* (Ws).

PRIVA MEXICANA (L.) Pers.

Additional & emended bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, imp. 1, 2: 41. 1791; Poir. in Lam., Tabl. Encycl. Méth. Bot. [Illustr. Gen.] 1: 59 & 60. 1791; Loud., Hort. Brit., ed. 1, 246. 1830; Schlecht. & Cham., Linnaea 5: 98--99. 1830; Loud., Hort. Brit., ed. 2, 246. 1832; G. Don in Loud., Hort. Brit., ed. 3, 247. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 552. 1839; Steud., Nom. Bot. Phan., ed. 2, 2: 397 & 750. 1841; D. Dietr., Syn. Pl. 3: 606. 1843; H. N. & A. L. Mold., Pl. Life 2: 33. 1948; Mold., Phytologia 44: 102 & 105--108. 1979; Mold., Phytol. Mem. 2: 54, 66, 73, 76, 94, 102, 359, 451, 462, & 573. 1980.

Arguelles reports finding this plant growing along with *Alnus, Fraxinus, Litsea, Taxodium, Quercus, Salvia,* and various composites. Ventura reports the stamens white, the corollas lilac, and the fruit green, and the species scarce at 2400 m. altitude.

Material of this species has been misidentified and distributed in some herbaria as *Verbena* sp. On the other hand, the *Hinton 17664,* distributed as *P. mexicana,* actually is *P. lappulacea* f. *albiflora* Mold.

Additional citations: MEXICO: Distrito Federal: *Miranda 311* (Me--74098); *Ventura A. 3031* (N). Hidalgo: *Ventura A. 1651* (Me--275718). México: *Hinton 18010* (Au). Querétaro: *Arguelles 1299* (Me--275938).

PRIVA MEYERI Jaub. & Spach

Additional bibliography: C. Muell. in Walp., Ann. Bot. Syst. 5: 705. 1860; Vierh., K. Akad. Wiss. Wien Denkschr. 71: 114 [434]. 1907; H. N. & A. L. Mold., Pl. Life 2: 72. 1948; Mold., Phytologia 44: 92 & 108--109. 1979; Mold., Phytologia Mem. 2: 201, 224, 228, 238, 241, 242, 244, 246, & 573. 1980; Mold., Phytologia 49: 62. 1981.

Recent collectors have found this plant at 1600 m. altitude, in

flower and fruit in February.

The *Dahlstrand 1638,* distributed as *P. meyeri,* actually is *P. cordifolia* var. *australis* Mold.

Additional citations: SOUTH AFRICA: Cape Province: *Drège a* [Mo. Bot. Gard. photo 866 in part] (Z--photo of cotype). Natal: *Collector undetermined 2202* [Mo. Bot. Gard. photo A.866 in part] (Z--photo). Transvaal: *Dahlstrand 1505* (Go).

PRIVA MEYERI var. *MADAGASCARIENSIS* Mold.

Additional bibliography: Mold., Phytologia 44: 109. 1979; Mold., Phytol. Mem. 2: 251 & 573. 1980.

PRIVA PEDICELLATA Mold.

Additional bibliography: Mold., Phytologia 44: 109--110. 1979; Mold., Phytol. Mem. 2: 273 & 573. 1980.

PRIVA PERUVIANA Mold.

Additional bibliography: Mold., Phytologia 44: 110. 1979; Mold., Phytol. Mem. 2: 135 & 573. 1980.

Recent collectors have encountered this plant on alluvial soil in clearings in mature forests, flowering and fruiting in October, describing it as an herb with green fruit. The corollas are said to have been "white" on the collection cited below.

Additional citations: PERU: Madre de Díos: *Gentry, Aronson, & Ramirez 26928* (Z).

PRIVA PORTORICENSIS Urb.

Additional bibliography: Mold., Phytologia 44: 110. 1979; Mold., Phytol. Mem. 2: 98 & 573. 1980.

PRIVA SOCOTRANA Mold.

Additional & emended bibliography: Balf. f., Trans. Roy. Soc. Edinb. 31: [Bot. Socotra] 232--233. 1888; Vierh., K. Akad. Wiss. Wien Denkschr. 71: 114 [434]. 1907; Mold., Phytologia 44: 110. 1979; Mold., Phytol. Mem. 2: 253 & 573. 1980.

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ADDITIONAL NOTES ON THE GENUS *VITEX*. XX

Harold N. Moldenke

VITEX Tourn.

Additional & emended bibliography: P. Herm., Mus. Zeyl., ed. 1, 47. 1717; L., Fl. Zeyl., imp. 2, 194--195. 1748; P. Browne in Sloane, Civil Nat. Hist. Jamaic., ed. 1, 267. 1756; Kwa-wi [transl. Savatier], Arbor. 4: pl. 1. 1789; P. Browne in Sloane, Civil Nat. Hist. Jamaic., ed. 2, 267. 1789; Wall. in Roxb., Fl. Ind., ed. 1, imp. 1, 1: 481--482. 1820; Roxb., Fl. Ind., ed. 1, imp. 1, 3: 70 & 71. 1824; Cham., Linnaea 7: 107--109, 371--375,

& 400. 1832; Wight, Icon. Pl. Ind. Orient. 2 (3): 1, pl. 519. 1842; Brongn., Enum. Gen. Pl., ed. 1, 65. 1843; D. Dietr., Syn. Pl. 3: 371 & 610--612. 1843; Walp., Repert. Bot. Syst. 6: 690. 1847; Walp., Ann. Bot. Syst. 1: 542 & 545. 1849; Brongn., Enum. Gen. Pl., ed. 2, 119 & 120. 1850; Hook. f., Fl. N. Zeal. 1 (3): 203. 1852; Miq., Fl. Ind. Bat. 1 (1): 858--865. 1856; C. Muell. in Walp., Ann. Bot. Syst. 5: 712. 1860; A. Wood, Class-book, [ed. 42], imp. 3, 539. 1864; Pfeiffer, Nom. Bot. 2 (2): 858 & 896. 1874; Mercado in Blanco, Fl. Filip., ed. 3, 4 Lib. Med. 36. 1880; Hemsl. in Thomson & Murray, Rep. Scient. Res. Voy. Challenger 3, Bot. 1: 110 & 177--178. 1885; Vidal y Soler, Phan. Cuming. Philip. 15, 39, 44, 64, 72, 134, & 135. 1885; F. Muell., Sec. Syst. Census Austr. Pl. 1: 173. 1887; Kuntze, Rev. Gen. Pl. 2: 510--511 & 513. 1891; Bocq., Fl. Febrig. Colon, Franç. 68. 1895; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 132--144 & 169--172. 1895; Woodrow, Journ. Bomb. Nat. Hist. Soc. 5: 12 & 359. 1899; Diels, Fl. Cent.-China 549. 1902; Post & Kuntze, Lexicon 103, 134, 589, & 688. 1904; Laing & Blackwell, Pl. N. Zeal., ed. 1, 210, 349--351, & 456, fig. 114. 1906; Koord. & Val., Atlas Baumart. Java 2: 6 & 201, pl. 292--299. 1914; Masuda, Bot. Mag. Tokyo 28: [418]. 1914; Chiov., Result. Scient. Miss. Stef. 1: 144 & 218. 1916; Basu, Indian Med. Pl., ed. 1, 3: 3 & 1936--1940, pl. 740--742. 1918; Parker, Forest Fl. Punj., ed. 1, 391 & 394. 1918; H. J. Lam in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 47--50. 1921; Bodding, Mem. Asiat. Soc. Beng. 10: 3, 7--9, 12, 40, 68, 75, 80, 88, 94, 96, 100, 103, & 199. 1925; Cheeseman, Man. N. Zeal. Fl., ed. 2, 763--765 & 1163. 1925; J. Hutchins., Fam. Flow. Pl., ed. 1, 309 & 327, fig. 263. 1926; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 2: 1313 & 1317--1319. 1927; Laing & Blackwell, Pl. N. Zeal., ed. 3, 354--356 & 468, fig. 127. 1929; Osmaston, Forest Fl. Kumaon 405--406. 1927; Fedde & Schust., Justs Bot. Jahresber. 47 (2): 423 & 426. 1929; W. Trelease, Wint. Bot., ed. 3, imp. 1, 323, 325, & 335. 1931; Madrid Moreno, Declar. Virt. Arb. Pl. 110 & 173. 1936; Makins, Ident. Trees Shrubs 259. 1936; Breyn, Prod. Fasc. Rar. Pl., ed. 2, 2: 106. 1939; Lam & Meeuse, Blumea 3: [248]--254. 1939; Laing & Blackwell, Pl. N. Zeal., ed. 4, 321, 371--373, & 499, fig. 139. 1940; Lall, Indian Forest. 48: 181--185. 1942; Van Melle, Shrubs Trees Small Place 48, 54, 55, & 177. 1943; Mitra, Chandran, & Rao, Science Cult. 14: 315--317. 1949; S. C. & D. Datta, Indian Pharm. 6. 1950; Masamune, Sci. Rep. Kanazawa Univ. 4: [Enum. Trach. 7]: 48--49. 1955; Pattnaik, Journ. Bomb. Nat. Hist. Soc. 54: 149. 1956; J. Hutchins., Fam. Flow. Pl., ed. 2, 1: 395. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 2: 1214. 1959; Puri, Indian Forest Ecol. 1: 31, 173, 183, & 229, pl. 50 (1960) and 2: 535 & 657. 1960; Li, Woody Pl. Taiwan 16, 816, 832--834, & 973, fig. 334. 1963; Sarma, Drag. Vigr. 1. 1963; Laing & Blackwell, Pl. N. Zeal., ed. 7, 321, 371--373, & 499, fig. 139. 1964; Poole & Adams, Trees Shrubs N. Zeal. 230. 1964; Beard, Descrip. Cat. West Austr. Pl., ed. 1, 93. 1965; Mallik & Chaudhuri, Bull. Bot. Soc. Beng. 22: 105--108, pl. 1. 1968; Guhabakshi & Naskar, Bull. Bot. Soc. Beng. 23: 175. 1969; Hiremath & al., Journ. Karnatak Univ. [14]: 30--48. 1969; Nisa &

Qadir, Pakist. Journ. Forest. 19: 205, 208--216, & 218. 1969; Beard, Descrip. Cat. West Austr. Pl., ed. 2, 113. 1970; Rao & Narayana, Riech. Arom. Korperpflrg. 20: 215--216, 218, 220, & 222. 1970; Shrivastava & Sisodia, Indian Vet. Journ. 47: 170--175. 1970; M. L. & M. M. Dhar, Dhawan, Gupta, & Srimal, Indian Journ. Exp. Biol. 9: 101. 1971; Farnsworth, Pharmacog. Titles 6 (6): xv & title 10764. 1971; Patel, Forest Fl. Gujarat 25, 228, & 230--231. 1971; "J.G.S.", Biol. Abstr. 52: 3659. 1971; Mold., Fifth Summ. 1: 31, 54, 61, 98, 107, 111, 112, 128, 134, 179, 207, 208, 239, 240, 253, 264, 266, 269, 270, 279, 281, 290, 291, 293, 294, 298, 303, 306, 311, 313, 318, 319, 328, 331, 374, 385, 386, & 396 (1971) and 2: 534, 573, 660, 684, 710--716, 718--721, 723--726, 728--730, 781, 785, & 927. 1971; Anon., Commonw. Myc. Inst. Index Fungi 3: 824. 1972; Fletcher in Hillier, Man. Trees Shrubs, ed. 2, imp. ed., 416. 1972; Fong, Farnsworth, Henry, Svoboda, & Yates, Lloydia 35: 35 & 46. 1972; Mahli & Trivedi, Quart. Journ. Crude Drug Res. 12: [1927]. 1972; Mold., Phytologia 23: 211--212, 315--316, 413--416, 418--421, 423, 424, 427, 430, 434, 438, 503, 506, & 512. 1972; Farnsworth, Pharmacog. Titles 9 (6): xii. 1973; Vohora, Khan, & Afaq, Indian Journ. Pharm. 35: 100--102. 1973; Vohora, Khan, & Afaq, Biol. Abstr. 57: 67;3. 1974; Tsagarelli, Bull. Acad. Sci. Georgian SSSR 78: 383 & 384. 1975; F. G. Mey., Journ. Arnold Arb. 57: 120 & 130. 1976; Babu, Herb. Fl. Dehra Dun 14 & 18. 1977; Fosberg, Falanruw, & Sachet, Micronesica 13: 30. 1977; Kodanda Rao & E. & D. Venkata Rao, Biol. Abstr. 64: 6284. 1977; Fosberg, Sachet, & Oliver, Micronesica 15: 239. 1979; Hocking, Excerpt. Bot. A.33: 86. 1979; Subramanian & Misra, Biol. Abstr. 67: 2338. 1979; Mold., Phytol. Mem. 2: 2, 6, 14, 17, 19, 21, 24--28, 41, 43, 47, 54, 55, 57, 59, 69, 73, 75--77, 80, 82, 84, 96, 98, 99, 101--104, 112, 121, 123--126, 130, 136, 171, 172, 176, 179--182, 193, 195--202, 204--207, 209--218, 211--224, 228--232, 234--236, 238, 239, 241--244, 246--248, 251--258, 265--267, 269, 271, 274, 275, 280, 282, 283, 287--290, 294, 297--299, 302--305, 309--311, 318, 319, 321, 323--325, 327--334, 339--343, 365--369, 372, 379, 395, 400, 405, 413, 422, 423, 430, 431, 435, 436, 442, 446, 456--460, 462, & 588--596. 1980; Mold., Phytologia 45: 485 & 491 (1980) and 48: 326, 413--419, 441, 442, 452--500, 505-510, & 512. 1981.

VITEX ACUMINATA R. Br.

Additional & emended bibliography: F. Muell., Sec. Syst. Census Austr. Pl. 1: 173. 1889; F. M. Bailey, Cat. Indig. Nat. Pl. Queensl. 35. 1890; Beard, Descrip. Cat. West Austr. Pl., ed. 1, 93 (1965) and ed. 2, 113. 1970; Mold., Phytologia 45: 479. 1980; Mold., Phytol. Mem. 2: 339, 458, & 588. 1980.

Additional citations: MOUNTED ILLUSTRATIONS: F. M. Bailey, Compreh. Cat. Queensl. Pl. fig. 362. 1909 (Z).

VITEX AGELAEIFOLIA Mildbr.

Additional bibliography: Mold., Phytologia 44: 224--225. 1979; Mold., Phytol. Mem. 2: 215, 221, & 588. 1980

VITEX AGELAEIFOLIA var. *RUFULA* Mold.
Additional bibliography: Mold., Phytologia 44: 225. 1979; Mold., Phytol. Mem. 2: 221 & 588. 1980

VITEX AGNUS-CASTUS L.
Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 133--135, 143, & 171. 1895; J. Hutchins., Fam. Flow. Pl., ed. 1, 1: 309, fig. 263. 1926; Savage, Cat. Linn. Herb. Lond. 110. 1945; Mold., Phytol. Mem. 2: 13, 14, 17, 19, 21, 24, 26, 41, 43, 47, 54, 55, 57, 59, 69, 96, 98, 99, 101, 103, 125, 171, 193, 195--200, 205, 241, 246, 254--256, 304, 318, 365, 366, 369, 372, 400, 436, 456--460, & 588. 1980; Mold., Phytologia 48: 415--417, 476, 477, 485, & 487--489. 1981.
Additional illustrations: J. Hutchins., Fam. Flow. Pl., ed. 1, 1: 309, fig. 263. 1926.

VITEX AGNUS-CASTUS f. *LACINIOSA* (Ces.) Mold.
Additional bibliography: Mold., Phytologia 44: 342. 1979; Mold., Phytol. Mem. 2: 197, 456--458, & 588. 1980.

VITEX AGNUS-CASTUS var. *PSEUDO-NEGUNDO* f. *ALBIFLORA* Mold.
Additional bibliography: Mold., Phytologia 44: 347. 1979; Mold., Phytol. Mem. 2: 254 & 588. 1980.

VITEX AGNUS-CASTUS f. *ROSEA* Rehd.
Additional bibliography: Mold., Phytologia 44: 347. 1979; Mold., Phytol. Mem. 2: 43, 197, 198, 366, 456, & 588. 1980.

VITEX AGNUS-CASTUS f. *VARIEGATA* Mold.
Additional bibliography: Mold., Phytologia 44: 347--348. 1979; Mold., Phytol. Mem. 2: 366, 456, & 588. 1980.

VITEX AJUGAEFLORA Dop
Additional bibliography: Mold., Phytologia 44: 348. 1979; Mold., Phytol. Mem. 2: 294, 366, & 588. 1980.

VITEX ALTISSIMA L. f.
Additional bibliography: Savage, Cat. Linn. Herb. Lond. 110. 1945: Mold., Phytologia 48: 417--418 & 476. 1981.
Recent collectors describe this plant as a tree, 10--25 m. tall, the leaves deciduous, the "petiole with a pulvinus at the base", the young ones prominently winged, the leaf-blades "tomentose beneath, the calyx pinkish, the anthers "dark" or "black", the filaments white, the fruit round, smooth, green, drupaceous, "turning purple in age", and have encountered it in wet deciduous, semi-evergreen, and dry deciduous forests, along streams, and on grassy slopes on hillocks, at 820 m. altitude, in anthesis from March to July, and in fruit in April and July. Ramamoorthy and Saldanha both report it "common" in Mysore, India. The corollas are described as having been "white but with the petals [=lobes?] and lower lip purplish" on *Saldanha 16875,* "purple" on *Saldanha 13425,* "white" on *Saldanha 13974,* "white with a prominent purple lip" on

Saldanha 16938, "white with a blue lower lip"on *Saldanha 13162*, "corolla lip purple" on *Nicolson & al. HFP.158*, and "lower lip of corolla purple, side lobes and upper 2 lobes purplish-white" on *Saldanha 16553*. Ramamoorthy, on his *no. HFP.1917*, comments "petioles winged toward base", but the wings are not obvious on the specimen of this collection so far seen by me (flowering).

Additional citations: INDIA: Karnataka: *Jarrett, Saldanha, & Ramamoorthy HFP.595* (W--2794856); *Nicolson, Saldanha, & Ramamoorthy HFP.158* (W--2794857), *HFP.206* (W--2794858); *Ramamoorthy HFP.1917* (W--2794849); *Saldanha 13162* (W--2794859), *13425* (W--2794854), *13707* (W--2794850), *13974* (W--2794851), *14093* (W--2794848), *16553* (W--2794852), *16875* (W--2794853), *16938* (W--2794855).

VITEX ALTISSIMA f. *SUBGLABRA* Thwaites

Additional bibliography: Mold., Phytologia 48: 418. 1981.

Kostermans refers to this plant as "very common" in dry valleys.

Additional citations: SRI LANKA: *Kostermans 26727* (Lc).

VITEX ALTMANNI Mold.

Additional bibliography: Mold., Phytologia 44: 360. 1979; Mold., Phytol. Mem. 2: 319 & 588. 1980.

VITEX AMANIENSIS Pieper

Additional bibliography: Mold., Phytologia 44: 360--361, 386, & 480. 1979; Mold., Phytol. Mem. 2: 228 & 588. 1980.

VITEX BREVILABIATA Ducke

Additional bibliography: Mold., Phytologia 45: 481. 1980; Mold., Phytol. Mem. 2: 171 & 588. 1980.

Additional citations: BRAZIL: Amazônas: *Prance, Berg, Bisby, Steward, Monteiro, & Ramos 18027* (Mu).

VITEX BREVIPETIOLATA Mold.

Additional bibliography: Mold., Phytologia 44: 392. 1979; Mold., Phytol. Mem. 2: 171 & 589. 1980.

VITEX BUCHANANII J. G. Baker

Additional bibliography: Mold., Phytologia 44: 392--393. 1979; Mold., Phytol. Mem. 2: 228, 236, 238, 239, 241, 457, & 589. 1980; Mold., Phytologia 48: 466. 1981.

VITEX BUCHANANII var. *QUADRANGULA* (Gürke) Pieper

Additional bibliography: Mold., Phytologia 44: 393. 1979; Mold., Phytol. Mem. 2: 228, 239, & 589. 1980.

VITEX BUCHNERI Gürke

Additional bibliography: Mold., Phytologia 44: 393 (1979) and 46: 30. 1980; Mold., Phytol. Mem. 2: 221, 224, & 589. 1980.

VITEX BUDDINGII Mold.

Additional bibliography: Mold., Phytologia 44: 393. 1979; Mold., Phytol. Mem. 2: 319 & 589. 1980.

VITEX BUNGUENSIS Mold.

Additional bibliography: Mold., Phytologia 44: 393--394. 1979; Mold., Phytol. Mem. 2: 228 & 589. 1980.

VITEX BURMENSIS Mold.

Additional bibliography: Mold., Phytologia 44: 394. 1979; Mold., Phytol. Mem. 2: 274 & 589. 1980.

VITEX CALOTHYRSA Sandw.

Additional bibliography: Mold., Phytologia 48: 419. 1981.

Additional citations: COLOMBIA: Vaupés: *Schultes, Baker, & Cabrera 18171* (Lc).

VITEX COFASSUS Reinw.

Additional bibliography: Mold., Phytologia 48: 454. 1981.

Craven & Schodde describe this species as a buttressed tree, 12--35 m. tall, the trunk with a diameter of 14 cm. at breast height, the bark stringy, flaky, pale-gray, with a pale-brown blaze, or striate, pale-green outside, pale-cream inside, the wood deep-cream, the sapwood yellow "to gray-brown in heartwood", the leaves dull mid-green or rather dull dark-green above, paler beneath, the young fruit dull-green or dull mid-green, and have found it growing in alluvial-freshwater tidal forests at sealevel and in primary rainforests at 125 m. altitude, flowering and fruiting in February. The corollas are said to have been "mauve-purple" on their *no. 704* (of which a wood sample was also collected) and "mauve-blue" on their *no. 4497*.

Additional citations: NEW GUINEA: Papua: *Craven & Schodde 704* (W--2896262); *Schodde & Craven 4497* (W--2896062).

VITEX CYMOSA Bert.

Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 143. 1895; Mold., Phytologia 48: 456. 1981.

Additional citations: BRAZIL: Amazonas: *Byron 145* (W--2920718).

VITEX GLABRATA R. Br.

Additional & emended bibliography: F. Muell., Sec. Syst. Census Austr. Pl. 1: 173. 1889; F. M. Bailey, Cat. Indig. Nat. Pl. Queensl. 35. 1890; Beard, Descrip. Cat. West Austr. Pl., ed. 1, 93 (1965) and ed. 2, 113. 1970; Mold., Phytologia 48: 458. 1981.

VITEX LEUCOXYLON L. f.

Additional bibliography: Savage, Cat. Linn. Herb. Lond. 110. 1945; Mold., Phytologia 48: 458, 460, 483, & 487. 1981.

VITEX LEUCOXYLON f. *SALIGNA* (Roxb.) Mold.

Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 134. 1895; Mold., Phytologia 48: 460. 1981.

VITEX LOBKOWITZII Ettingsh.

Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam. , ed. 1, 4 (3a): 143. 1895; Mold. , Phytologia 46: 21. 1980; Mold., Phytol. Mem. 2: 369 & 591. 1980.

VITEX LUCENS T. Kirk

Additional bibliography: Poole & Adams, Trees Shrubs N. Zeal. 230 & 233. 1964; Mold., Phytologia 48: 461. 1981.

Additional illustrations: Poole & Adams, Trees Shrubs N. Zeal. 233. 1964.

Poole & Adams (1964) point out that the specific epithet awarded this species refers to the glossy or lustrous upper leaf-surface. They describe the species as a tree, to 20 m. tall, with plainly tetragonal branchlets, the leaflets 3--5 in number, each 5--12 cm. long, elliptic-oblong or obovate in shape, the flowers 2.5 cm. long , the corollas red, and the drupes also red, 2 cm. in diameter. They describe its distribution in New Zealand forests from North Cape to the Mahia Peninsula and Cape Egmont.

Additional citations: MOUNTED ILLUSTRATIONS: Poole & Adams, Trees Shrubs N. Zeal. 233. 1964 (Z, Z).

VITEX MOLLIS H.B.K.

Additional bibliography: Walp., Ann. Bot. Syst. 1: 545. 1849; Mold., Phytologia 48: 462. 1981.

Additional citations: MEXICO: Guerrero: *López Forment 928* (Me--284806).

VITEX NEGUNDO L.

Additional bibliography: Savage, Cat. Linn. Herb. Lond. 110. 1945; Mold., Phytologia 48: 466--500. 1981.

The *Ramamoorthy HFP.374* and *Saldanha 12470,* distributed as typical *V. negundo,* actually represent its var. *trifoliolata* Mold.

VITEX NEGUNDO var. *CANNABIFOLIA* (Sieb. & Zucc.) Hand.-Mazz.

Additional bibliography: Walp., Ann. Bot. Syst. 1: 542. 1849; Mold., Phytologia 48: 487, 489, & 492--500, fig. 1--5. 1981.

In the previous supplement to my Additional Notes on this genus I began a quotation from the late O. F. Cook's description of anisophylly in what was taken to represent this variety [but actually is var. *intermedia* (P'ei) Mold.]. His description continues as follows: "Even when the leaf that should be underneath in the normal position is brought to the upper side by the twisting of the branch the growth of the larger leaf is not inhibited by its more exposed position, nor does the smaller leaf take advantage of its more protected position to increase in size. In any particular case it is impossible, of course, to say that the leaves of a pair are more or less unequal than they might have been if grown in some different position. But it is evident that there is no general loss or even an apparent reduction of the normal anisophylly as a result of modification of position and exposure.

"A further possibility of securing evidence of this kind by observing the behavior of leaves of equal pairs has been consider-

ed, but without securing any very definite results. In some cases there seemed to be quite a tendency to inequality between the leaves of the equal pairs when the exposure was abnormal, but in other cases there was no apparent difference. Equal pairs standing in vertical positions seemed to be as nearly equal as where they had lateral positions on adjoining branches. It was thought at first that the tendency to bilateral asymmetry disappeared when leaves of equal pairs developed in vertical positions, but this was not always the case. When branches were turned over by twisting the larger divisions were developed on the side of the leaf that had the superior position, even in pairs of

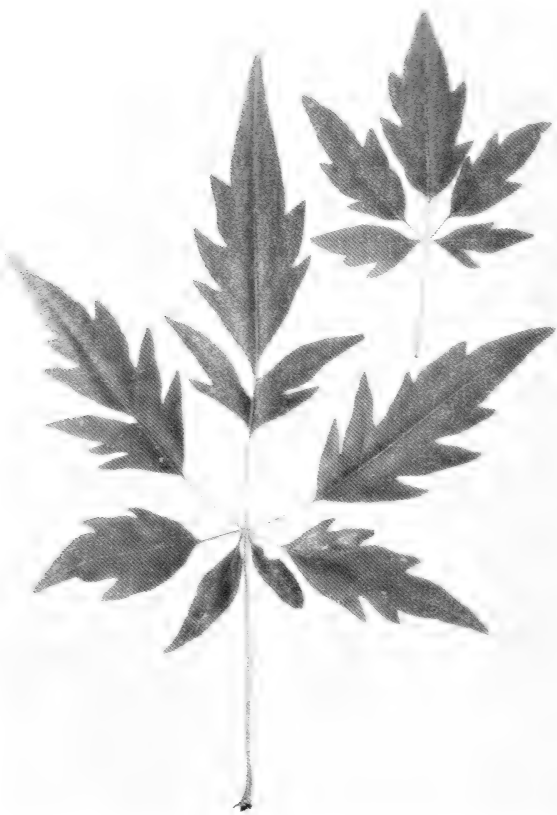

Fig. 6. Paired leaves showing difference in form as well as size

leaves that showed an unusual tendency to inequality of size. Thus in figure 8, representing a pair of leaves grown in reversed position on a twisted branch, the larger divisions were produced on the sides of the leaves that has a superior or more exposed position. That greater exposure has no pronounced effect of inhibiting the development of leaves in more exposed positions was also shown in many cases where the lower leaf was smaller in a normally equal pair, developed in a vertical position.

Fig. 7. Paired leaves showing differences in form as well as size in case of shade leaves

"Instead of ascribing the anisophylly of *Vitex* to direct effects of gravitation or light upon the development of the parts of the plant it seems to have more connection with the structure and habits of growth of the plant. In view of the normally ascending position of the branches it is easy to understand the ad-

aptive advantage of larger development on the outer or more ex- . posed sides of the branches and of smaller development of leaves and branches in the more unfavorable axillary position, between the lateral branch and the upright parent shoot. Whether the in-

Fig. 8. An asymmetric pair of equal-sized leaves

feriority of the leaves and buds of the upper or inner face of the branch is due directly to the less favorable position of their primordia on the axillary side of the branch or represents a specialized character in heredity may be difficult to determine, but it is evident that the differences depend upon the peculiarities of the plant rather than upon the influences of the external environment. The fact that the inequality diminishes or disappears in shoots that start in an upright position is not a reason for looking upon the specializations of oblique and horizontal branches as direct results of environmental influence. On the contrary, it may serve as a further indication that the inequality of the sides of the lateral branches represents a specialized condition of heredity, but capable of being reversed like other states of expression of characters. That the plants are capable of producing symmetrical upright shoots only shows the more clearly that the peculiarities of the lateral shoots are in the nature of specializations. That different kinds of shoots can be produced in different positions does not prove that the changes are caused by the external conditions, but is an evidence of the adaptive ability of the plant.

"One more possibility is worthy of consideration, that the very pronounced anisophylly of *Vitex* is a product of two factors. The inequality of the two sides of the branches, as considered above, may be supplemented or intensified by an inequality of internodes. If we consider that the opposite positions of the leaves represents a suppression of alternate joints or internodes of the stem it becomes possible to understand that the large joints might naturally tend to produce larger leaves and branches than the alternating small joints.

"Even when branches are brought into positions where the larger leaves of the unequal pairs should be uppermost, as when shoots are given off near the tops of large branches that are bent over, the usual position of the leaves is often regained through the twisting of the branches by the greater weight of the leaves on one side, tending to this side underneath.

"The idea that too much light may inhibit the growth of the leaves on the upper sides of the branches may find some support in the fact that anisophylly is often unusually pronounced on shoots that arise on very exposed parts of the plants, though all the leaves tend to be small on such branches, in comparison with the size attained in lower or more sheltered places. But if this factor were significant the inequality should disappear on branches that are heavily shaded (Fig. 7), or where the lower side receives more light than the upper, but even in such cases the inequality often remains very great."

All things considered, it seems to me that the plants with which Cook was experimenting here are neither typical *V. negundo* L., nor its var. *cannabifolia* (Sieb. & Zucc.) Hand.-Mazz. nor var. *heterophylla* (Franch.) Rehd., but represent the var. *intermedia* (P'ei) Mold.

Material of *V. negundo* var. *cannabifolia* has been misidentified and distributed in some herbaria as *V. heterophylla* Roxb., *V. incisa*

Lam., *V. negundo* L., *V. negundo* var. *heterophylla* (Franch.) Rehd., *V. negundo* var. *incisa* (Lam.) C. B. Clarke, and *V. quinata* (Lour.) F. N. Will. On the other hand, the *Chow 7*, distributed as var. *cannabifolia*, probably is better regarded as var. *intermedia* (P'ei) Mold.

Additional citations: INDIA: Punjab: *T. Thomson s.n.* [Punjab, 1--4000 ped.] (Mu--655). Tamil Nadu: *G. Thomson s.n.* [Maisor & Carnatic] (Mu--656). CHINA: Fukien: *Cheng 3366* (Mu); *En 2810* (Mu); *Ging 5143* (Ws),*6651* (Ws). Kwangsi: *Wan & Chow 79016* (N). Kweichow: *Tsiang 8518* (Mu). Shantung: *Zimmermann 442* (Mu--3958). CHINESE COASTAL ISLANDS: Lantau: *Hu 10244* (W--2731441). THAILAND: *Zimmermann 2* (Mu--3964). MALAYA: Johore: *Poore 296* (Kl--296). Perak: *Chin 843* (Kl--15297). MALAYAN ISLANDS: Langkawi: *Abd 15* (Kl--2015). JAPAN: Honshu: *Maximowicz s.n.* [Yokohama 1862] (Mu--1518); *Siebold s.n.* [in Japonia legit] (Mu--626--isotype, Mu--627--isotype). CULTIVATED: India: *Herb. Hort. Bot. Calcut. s.n.* (Pd). New York: *Moldenke & Moldenke 11865* (N). MOUNTED CLIPPINGS: Walker, Pl. Okin. South. Ryuk. 894. 1976 (W).

VITEX NEGUNDO var. *DENSIFLORA* Haines, Bot. Bihar Orissa, ed. 1, 4: 712. 1922.

Additional & emended bibliography: Haines, Bot. Bihar Orissa, ed. 1, 4: 712 (1922) and ed. 2, 2: 746. 1961; Mold., Phytologia 15: 308--309. 1967; Mold., Fifth Summ. 1: 279 (1971) and 2: 927. 1971; Mold., Phytol. Mem. 2: 256, 266, 459, & 592. 1980.

VITEX NEGUNDO var. *HETEROPHYLLA* (Franch.) Rehd.

Additional & emended synonymy: *Vitex sinuata* Raeusch., Nom. Bot., ed. 3, 182, nom. nud. 1797; Steud., Nom. Bot., ed. 1, 888, nom. nud. 1821. *Vitex negundo* Bot. Mag. ex Sweet, Hort. Brit., ed. 1, 1: 323, in syn. 1826 [not *V. negundo* L., 1753, nor Lour., 1934, nor Noronha, 1790, nor Royle, 1919, nor Willd., 1918]. *Vitex ircisa* F. P. Sm., Contrib. Mat. Med. China 227, sphalm. 1871. *Vitex incisa* var. *heterophylla* Franch., Nouv. Arch. Mus. Hist. Nat. Paris, ser. 2, 6: 112. 1883. *Vitex negundo* sensu Curtis apud Rehd., Journ. Arnold Arb. 28: 258, in syn. 1947. *Vitex negundo heterophylla* Blackburn, Trees Shrubs East. N. Am. 303. 1952. *Vitex negundo* var. *incisa* Clarke ex Roberty, Pet. Fl. Ouest-Afr. 178. 1954. *Vitex negundo incisa* (Bunge) Clarke ex Enari, Ornament. Shrubs Calif. 170, in syn. 1962. *Vitex negundo* cv.*'Incisa'* Enari, Ornament. Shrubs Calif. 170. 1962. *Vitex negundo 'Heterophylla'* Sherk & Buckley, Ornament. Shrubs Canada 164. 1968. *Vitex negundo incisa* (Lam.) Clarke ex Mold., Fifth Summ. 2: 724, in syn. 1971. *Vitex negundo* var. *heterophylla* Rehd. apud R. G. & M. L. Br., Woody Pl. Md. 288 & 289. 1972. *Vitex laciniata* "Hort. ex Schauer" ex L. H. & E. Z. Bailey, Hortus Third 1162, in syn. 1976. *Vitex negundo* var. *incisa* "(Lam.) C. B. Clarke in Hook. f." ex Mold., Phytol. Mem. 2: 459, in syn. 1980.

Additional & emended bibliography: Lam., Encycl. Méth. Bot. 2: 612. 1788; Raeusch., Nom. Bot., ed. 3, 182. 1797; Desf., Tabl. Écol. Bot., ed. 1, 53. 1804; Willd., Enum. Pl. Hort. Berol. 2: 660. 1809;

Balbis, Cat. Stirp. Hort. Acad. Taur. 81. 1813; Roxb., Hort. Beng., imp. 1, 46. 1814; Desf., Tabl. Écol. Bot., ed. 2, 64. 1815; Sweet, Hort. Brit., ed. 1, 322. 1826; Wall., Numer. List [47], no. 1746. 1829; Loud., Hort. Brit., ed. 1, 246. 1830; Sweet, Hort. Brit., ed. 2, 416. 1830; Wall., Numer. List 86, no. 1746D. 1831; Loud., Hort. Brit., ed. 2, 246. 1832; Roxb., Fl. Ind., ed. 2, imp. 1, 3: 72--73. 1832; Bunge, Enum. Pl. Chin.-Bor. 52. 1833; Bunge, Mém. Div. Sav. Acad. Sci. St. Pétersb. 2: 216. 1835; G. Don in Loud., Hort. Brit., ed. 3, 246. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 551. 1839; Spach, Hist. Nat. Veg. Phan. 9: 232. 1840; Hassk., Cat. Pl. Hort. Bot. Bogor. Cult. Alt. 134. 1844; Voigt, Hort. Suburb. Calc. 469. 1845; Buek, Gen. Spec. Syn. Candoll. 3: 502. 1858; Dupuis, Nouv. Fl. Usuel. Med. 2: 298. 1860; A. Gray, Man. Bot. North. U. S., ed. 3, lxvii (1862), ed. 4, imp. 1, lxvii (1863), and ed. 4, imp. 2, lxvii. 1864; A. Gray, Field For. Gard. Bot., ed. 1, imp. 1, 243 (1868) and ed. 1, imp. 2, 243. 1869; A. Gray, Man. Bot. North. U. S., ed. 4, imp. 3, lxvii. 1870; A. Wood, Am. Bot. Flor., ed. 1, imp. 1, 237 (1870) and ed. 1, imp. 2, 237. 1871; F. P. Sm., Contrib. Mat. Med. China 227. 1871; A. Wood, Am. Bot. Flor., ed. 1, imp. 3, 237 (1872) ed. 1, imp. 4, 237 (1873), and ed. 1, imp. 5, 237. 1874; Roxb., Fl. Ind., ed. 2, imp. 2, 482. 1874; A. Wood, Am. Bot. Flor., ed. 1, imp. 6, 237. 1875; A. Gray, Field For. Gard. Bot., ed. 1, imp. 3, 243. 1880; Franch., Nouv. Arch. Mus. Hist. Nat. Paris, ser. 2, 6: 112. 1883; Franch., Pl. David., imp. 1, 1: 232. 1884; O. R. Willis in A. Wood., Am. Bot. Flor., ed. 2, 237. 1889; Forbes & Hemsl., Journ. Linn. Soc. Lond. Bot. 26 [Ind. Fl. Sin. 2]: 257. 1890; Voss in Vilm., Blumengärt. 1: 829. 1895; K. Schum. & Lauterb., Fl. Deutsch. Schutzgeb. Südsee 524. 1900; Diels, Fl. Cent.-China 549. 1902; Stuart, Chin. Mat. Med. 1911; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; Rehd. in Sarg., Pl. Wils. 3: 33, 373, & 374. 1916; H. Hallier, Meded. Rijks Herb. Leid. 37: 44. 1918; Lázaro e Ibiza, Compl. Fl. Espan., ed. 3, 3: 298. 1921; Haines, Bot. Bihar Orissa, ed. 1, 4: 712. 1922; Nakai, Fl. Sylv. Kor. 14: 38, pl. 12. 1923; Wangerin, Justs Bot. Jahresber. 51 (1): 554. 1923; Haines, Bot. Bihar Orissa, ed. 1, 6: 712. 1924; Parker, Forest Fl. Punj., ed. 2, 395. 1924; Janssonius, Mikrogr. Holz. 812. 1926; E. D. Merr., Lingnan Sci. Journ. 5: 158. 1927; Vansell & Eckert, Univ. Calif. Agr. Exp. Sta. Bull. 517, imp. 1, 52 & [60]. 1931; Fedde, Justs Bot. Jahresber. 51 (2): 385. 1933; L. H. & E. Z. Bailey, Hortus 639. 1935; Makins, Ident. Trees Shrubs 259. 1936; Parks, Texas Agr. Exp. Sta. Bull. 155: 113. 1937; W. Trelease, Pl. Mat. Decorat. Gard. Woody Pl., ed. 5, imp. 1, 146. 1940; Fedde & Schust., Justs Bot. Jahresber. 60 (2): 576. 1941; Vansell & Eckert, Univ. Calif. Agr. Exp. Sta. Bull. 517, imp. 2, 76. 1941; Everett, Cat. Hardy Trees Shrubs 120. 1942; E. L. D. Seymour, New Gard. Encycl., ed. 3, 1292. 1944; Savage, Cat. Linn. Herb. Lond. 110. 1945; E. L. D. Seymour, New Gard. Encycl., ed. 4, 1292 (1946) and ed. 5, 1292. 1951; Blackburn, Trees Shrubs East. N. Am. 303. 1952; Pételot, Pl. Méd. Camb. Laos Vietn. 2: 248 (1954) and 4: 171. 1954; Roberty, Pet. Fl. Ouest-Afr. 178. 1954; Bean in Chittenden, Dict. Gard., imp. 1, 4: 2249 & 2250. 1956; Wyman, Shrubs

Vines Am. Gard. 351 & 352. 1956; Viertel, Trees Shrubs Vines, imp. 1, no. 406. 1959; Haines, Bot. Bihar Orissa, ed. 2, 2: 746. 1961; Enari, Ornament. Shrubs Calif. 170. 1962; E. L. D. Seymour, New Gard. Encycl., ed. 6, 1292 (1963) and ed. 7, 1292. 1964; Bean in Chittenden, Dict. Gard., imp. 2, 4: 2249 & 2250. 1965; Everett, Reader's Digest Compl. Book Gard. 447 & 661. 1966; Mold., Phytologia 17: 15, 17--19, 22, 23, 28, & 29. 1968; Mold., Résumé Suppl. 16: 29 (1968) and 17: 8 & 12. 1968;Sherk & Buckley, Ornament. Shrubs Canada 164. 1968; W. Trelease, Pl. Mat. Decorat. Gard. Woody Pl., ed. 5, imp. 2, 146. 1968; G. W. Thomas, Tex. Pl. Ecolog. Summ. 78. 1969; Franch., Pl. David., imp. 2, 1: 232. 1970; McGourty [editor], 1200 Trees [Plants Gard. 26 (2):] 53. 1970; Mold. in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. 6:] 1340 & 1878. 1970; E. L. D. Seymour, New Gard. Encycl., ed. 8, 1292. 1970; Viertel, Trees Shrubs Vines, imp. 2, no. 406. 1970; Hartwell, Lloydia 34: 388. 1971; Mold., Fifth Summ. 1: 54, 61, 128, 291, 318, 374, 385, & 386 (1971) and 2: 534, 710, 712, 713, 715, 719, 720, 723, 724, 728, & 927. 1971; Priszter, Delect. Sem. Spor. Pl. Hort. Bot. Univ. Hung. 59. 1971; Roxb., Fl. Ind., ed. 2, imp. 3, 482. 1971; Wyman, Gard. Encycl., imp. 1, 1171 (1971) and imp. 2, 1171. 1972; R. G. & M. L. Br., Woody Pl. Md. 288 & 289. 1972; Encke & Buchheim in Zander, Handwörterb. Pflanzennam., ed. 10, 525. 1972; Farnsworth, Pharmacog. Titles 7 (4): xxvi & 222. 1972; Mold., Phytologia 23: 427 & 438. 1972; R. R. Stewart, Annot. Cat. in Nasir & Ali, Fl. West. Pakist. 608. 1972; Gibbs, Chemotax. Flow. Pl. 3: 1754. 1974; Howes, Dict. Useful Pl. 52. 1974; Whitney in Foley, Herbs Use Delight [204]. 1974; [Farnsworth], Pharmacog. Titles 7, Cum. Gen. Ind. [118]. 1975; Kooiman, Act. Bot. Neerl. 24: 462. 1975; López-Palacios, Revist. Fac. Farm. Univ. Andes 15: 101. 1975; Mold., Phytologia 31: 380. 1975; Wyman, Gard. Journ. 25: [45] & 46. 1975; L. H. & E. Z. Bailey, Hortus Third 1161 & 1162. 1976; Mold., Phytologia 34: 279. 1976; C.-W. Li, China Reconstr. 27 (2): 4. 1978; Wang, Act. Entomol. Sin. 21: 343--344. 1978; Mold., Phytologia 44: 225. 1979; Wang, Biol. Abstr. 68: 4667. 1979; Mold., Phytol. Mem. 2: 28, 47, 54, 96, 280, 309, 367, 458, 459, & 592. 1980; Roxb., Hort. Beng., imp. 2, 46. 1980; Mold., Phytologia 48: 489. 1981,

Additional illustrations: Bean in Chittenden, Dict. Gard., imp. 1, 4: 2250 (1956) and imp. 2, 4: 2250. 1965; R. G. & M. L. Br., Woody Pl. Md. 289. 1972.

This is a natural variety, native to northern China and Mongolia (Baileys, 1976) or only northern China (Bean, 1976, Spach, 1840). Desfontaines (1804), Sweet (1826), and Lázaro e Ibiza (1921) give its native distribution merely as "China". There is no justification whatever in changing its status to that of a cultivar as some recent writers have proposed! The same is true of the other infraspecific taxa in *V. negundo, V. agnus-castus,* etc. Modern writers are all too prone to regard all taxa growing in cultivation as ipso facto cultivars -- in many cases this is not at all the case!

Wyman (1956) states that the present variety was first introduced into cultivation in 1750 from "China or Korea", but

Sweet (1826) and Don (1830) give the date as 1758 from "China". Voigt (1845) lists it as in cultivation in Calcutta in 1845, while Lazaro e Ibiza (1921) record it from Spanish gardens. Roberty (1954) tells us that this is the "form" of *Vitex negundo* ["à folioles profondément dentées"] generally cultivated in western Africa. Enari (1962) reports that in California it is usually cultivated as "*Vitex laciniata*", having "deeply toothed, incised or cut leaflets". Sherk & Buckley (1968) claim that it is hardier than *V. agnus-castus* and is even root-hardy as far north as Ottawa, Canada, where it blooms in September and October. Priszter (1971) offered its seeds to the horticultural trade from cultivated plants in Hungary. Everett (1942) found the "*castaneaefolia*" form cultivated in the Lu Shan Arboretum. He claims that var. *heterophylla* will grow in the Rocky Mountain region of western North America. The Meebold collection from Vienna, Austria, is said to have come from seeds imported from "tropical Asia".

Spach (1840) says "Cette espèce, originaire du nord de la Chine, se cultivé fréquemment comme arbrisseau d'ornement; elle est très-rustique; sa floraison a lieu en août et septembre." Clarke (1885) says of it that it occurs "Throughout India. Distrib. E. Asia. -- The extreme pinnatifid form of this var. is Chinese; the wild Indian examples are crenate-serrate, i.e. intermediate.

Voss (1895) says of it: "blassblau, die Blättchen sind fiederlappig. Blütezeit: Juli, August. -- Verwendung in Sommer als angenehme, im Freien aufzustellende Kübelsträucher. Überwinterung im Kalthaus oder hellen Keller. Vermehrung durch Stecklinge, Grundisprosse und Wurzelschnittlinge. Ansucht aus Samen, die lauwarm zu halten. -- Keimkraft der Samen 1--2 Jahre; Keimung frischer Samen erst nach 1 Jahr; ältere liegen noch länger."

Smith (1871) records the name "man-king", for this plant in China, where, he says, the fruits are imported from Honan, Shensi, and Pehchihli. He describes these fruits as "berries globular, black, nucumentaceous, usually covered with remains of the calyx or mixed with its dried leaves. Interior is white, ligneous, and made of 4 carpels in a state of adhesion". He says that they have little taste or smell and are "inert as sold in Hankow". The material is prescribed in the treatment of headaches, catarrh, watery eyes. It is supposed to promote the growth of the beard - "that great object of the middle life of every Chinaman". Li (1978) reports that in animal tests and in clinical use the same results obtain as from the use of var. *cannabifolia* fruit. Gibbs (1974) asserts that syringin is absent from the stems and that negative results are obtained with the HCl/methanol test.

Parks (1937) calls the variety the "Japanese vitex" and says that "It grows more as a bush than the other species and has light green leaves with no odor. The plant bears throughout the summer large numbers of light blue flowers. These have the habit of opening about ten o'clock A. M. and remaining open until after dark. It is a fine honey plant and it is not uncommon to see

bees working it until the darkness causes them to leave or to remain on the plant. This is a species that should be very largely procured from nurseries [in Texas] as it is a most valuable ornamental." Vansell & Eckert (1931) also describe the corollas as blue, adding that the color of the honey is greenish-white, but that the value of the plant as a source of nectar and pollen for bees is minor.

Stewart (1972) regards this variety as identical with typical *Vitex negundo* L., but, of course, it is very distinct. Blackburn (1952) describes typical *V. negundo* as having its leaflets rather shallowly toothed "or occasionally entire". while var. *heterophylla* has the leaflets "deeply toothed or cut" and f. *multifida* has them "cut into narrow segments reaching almost to the midrib".

The Baileys (1976) describe the leaflets of var. *heterophylla* as "smaller, deeply toothed or cut". Dunn & Tutcher (1912) say for the typical *V. negundo* "Leaflets large, entire or coarsely toothed" and for our variety "Leaflets small, deeply cut". Parker (1924) avers that "The form with more ovate-lanceolate coarsely serrated leaves is var. *incisa* (sp. Lamk.) [now known as var. *heterophylla*]; it passes into the typical form and both kinds of foliage may sometimes be found on the same plant" [the presentday var. *intermedia*]. Atkins (1936) calls it "A smaller shrub, with smaller fl.-panicles and berries". The fruits, of course are drupes, not berries.

Hallier (1918) describes the present variety as "Ein junger, noch nicht blühenden Bäumchen einer wahrscheinlich neuen dem *V. incisa* verwandten Art mit fünfgliedrigen Blättern und gestielten, nach Art der *Quercus palustris* scharf fiederlappigen Blättchen fand ich am 21.II.1904 auf den Boden des gelichteten Hochwaldes hinter San Ramon auf S.W.-Mindanao (*no. 4712,* Hb. Hamb., Manill., L.-B.)."

Van Melle (1943) regards the "deeply toothed or incised" form as typical *V. negundo* and the "pinnately divided" form as var. *incisa* [=*heterophylla*]". Actually, the former is var. *heterophylla*, while the latter is f. *multifida*.

Recent collectors describe *Vitex negundo* var. *heterophylla* as a shrub, 1.5--2.5 m. tall, with diffuse branches and aromatic leaves and have found it growing in rocky clay limestone soil, at 200 m. altitude, in flower in May and July. Liogier encountered it "en manigua a orilla de la carretera". The corollas are said to have been "lavender" on *Fogg s.n.* and "R[oyal] H[orticultural] S[ociety] Aster violet, the lip 38, the lateral lobes 38/1, the upper lobes 38/3" on *Huttleston 1709*.

Common and vernacular names recorded for this taxon include "Chinese chaste tree", "cutleaf chaste-tree", "cutleaf chaste tree", "cut-leaved chaste tree", "cut-leaved chaste-tree", "cut-leaved chastetree", "gattilier incisé", "Japanese vitex", "man-king", "negundo", "pimentillo", and "vitex incisé".

The Schumann & Lauterbach (1900) reference in the bibliography (above) is usually cited by its titlepage date, "1901", but the New York Botanical Garden Library received its copy of the work on December 7, 1900.

The plant described and illustrated by Wyman (1975) as this variety actually is *Vitex agnus-castus* f. *latifolia* (Mill.) Rehd. On the other hand, the plant described and illustrated by Viertel (1959, 1970) as "*V. negundo incisa*" actually seems to be *V. negundo* var. *intermedia* (P'ei) Mold.

The *V. alba* Hort., *V. alba* Lam., *V. alba* var. *incisa* Hort., and *V. incisa* var. *alba* Hort., listed as synonyms of *V. negundo* var. *heterophylla* by me previously (1957) are now regarded by me as belonging to the synonymy of *V. negundo* var. *heterophylla* f. *alba* (Carr.) Mold.

Vitex chinensis Mill., generally accepted as a synonym of *V. negundo* var. *heterophylla*, is based on an unnumbered P. Miller specimen in the British Museum herbarium from the Chelsea Physic Garden, determined by R. Brown as "*Vitex incisa*". The specimen is in young fruit and on the reverse side of the sheet Solander has written "Miller, ex Hort."

Wang (1978) reports that the bee, *Scolia clypeata* Sickman, secures nectar from the plant here under discussion, as well as from *Tamarix chinensis, Mentha arvensis, M. spicata, Melilotus suaveolens, Medicago sativa, Solidago* sp., *Rudbeckia laciniata* var. *hortensis,* and *Salix matsudana,* in the area of Peking, China. Schumann & Lauterbach (1900) cites *Lesson s.n.* from Ceram.

Material of this taxon has been widely misidentified and distributed in herbaria as typical *V. negundo* L. On the other hand, the *Chang 8253, Ging 5143* & *6651,* and *Zimmermann 442,* distributed as var. *heterophylla,* actually represent var. *cannabifolia* (Sieb. & Zucc.) Hand.-Mazz., while *E. Murray 1148* and *H. Rhodes 47-64-122 SM.84A* are *V. negundo* var. *heterophylla* f. *multifida* (Carr.) Rehd. and *E. M. Alexander 35, Allard 11390, Cutler 5043* , and *Ging 5388, 5956,* & *6740* are var. *intermedia* (P'ei) Mold.

Additional citations: OKLAHOMA: Payne Co.: *G. E. Hall 22* (Au--122931). Tulsa Co.: *Hays 91* (Au--122930). HISPANIOLA: Haiti: *A. H. Liogier 21397* (N). CHINA: Hopeh: *Herb. Inst. Bot. Acad. Sin. 75084* (Ac, Ac, N); *Tatarinow s.n.* [Fl. Pekin.] (W--2525123, W--2560205). PHILIPPINE ISLANDS: Luzon: *Merritt & Darling s.n.* [Herb. Philip. Forest. Bur. 14051] (W--711498). CULTIVATED: Arizona: *Thornber 7369* (Au--245703). Austria: *Meebold 17404* (Mu). California: *Jerabek s.n.* [Balboa Park, June 1945] (Sd--36461), *s.n.* [Balboa Park, Sept. 1945] (Sd--37000). Egypt: *Mahdi s.n.* [16/7/1963] (Gz, Gz), *s.n.* [10/11/1963] (Gz, Gz), *s.n.* [25/6/1965] (Gz, Gz), *s.n.* [4/6/1967] (Gz, Gz). England: *P. Miller s.n.* [Chelsea Physic Gard.; Bailey Hort. neg. 5055] (Ba--photo). Florida: *Godfrey 55555* (Ld). New Zealand: *Sykes 88/62* (Nz--125876). Pennsylvania: *Fogg s.n.* [August 7, 1969] (Ba); *Huttleston 1709* [Longw. Gard. 571138] (Ba). Texas: *Rowell 5801* (Au--187069); *R. Runyon 65* (Au--270235), *3552* (Au--270201). Virginia: *Allard 11390* (Ws).

VITEX NEGUNDO var. *HETEROPHYLLA* f. *ALBA* (Carr.) Mold.

Additional & emended synonymy: *Vitex incisa alba* Desf., Tabl. Écol. Bot., ed. 1, 53. 1804. *Vitex alba* Hort. ex Mold., Prelim. Alph. List Inv. Names 49, in syn. 1940. *Vitex incisa* var. *alba*

Hort. ex Mold., Prelim. Alph. List Inv. Names 51, in syn. 1940. *Vitex alba* Lam. ex Mold., Phytologia 5: 502, in syn. 1957. *Vitex alba* var. *incisa* Hort. ex Mold., Phytologia 5: 502, in syn. 1957. *Vitex negundo alba* Hort. ex Mold., Phytologia 5: 502, in syn. 1957.

Additional bibliography: Desf., Tabl. Écol. Bot., ed. 1, 63 (1804) and ed. 2, 64. 1815; Mold., Phytologia 17: 19. 1968; Mold., Fifth Summ. 1: 374 & 385 (1971) and 2: 927. 1971; Mold., Phytol. Mem. 2: 367 & 592. 1980.

VITEX NEGUNDO var. *HETEROPHYLLA* f. *MULTIFIDA* (Carr.) Rehd.

Additional synonymy: *Vitex negundo* f. *multifida* Rehd. ex L. H. Bailey, Stand. Cycl. Hort. 6: 3574 [as "*V. N.* f. *multifida*"]. 1917. *Vitex negundo heterophylla* f. *multifida* Blackburn, Trees Shrubs East. N. Am. 303. 1952.

Additional bibliography: C. B. Clarke in Hook. f., Fl. Brit. India 4: 584. 1885; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; Lázaro e Ibiza, Compl. Fl. Espan., ed. 3, 3: 298. 1921; Van Melle, Shrubs Trees Small Place 48, 55, & 177. 1943; Blackburn, Trees Shrubs East. N. Am. 303. 1952; Mold., Phytologia 17: 18 & 19. 1968; Mold., Résume Suppl. 16: 29 (1968) and 17: 12. 1968; Mold., Fifth Summ. 1: 291, 374, 385, & 386 (1971) and 2: 716, 719, 723, 724, 781, 785, & 927. 1971; Mold., Phytol. Mem. 2: 280, 367, & 592. 1980.

This form is a naturally occurring one from the Peking area of Hopeh, China, now widely cultivated (and even escaped), with the leaflets small and pinnatifidly cut or divided into narrow and distant segments reaching almost to the midrib. It appears to be the form regarded as "var. *incisa*" by Van Melle (1943) and by Dunn & Tutcher (1912). It is included in "*V. incisa*" by Lázaro e Ibiza (1921). Clarke (1885) regarded it as "the extreme pinnatifid..... Chinese" form of *V. negundo* var. *incisa* as distinguished from "the wild Indian.....crenate-serrate" form.

Murray describes the plant as 2 m. tall and found it in fruit in September.

Additional citations: CULTIVATED: Pennsylvania: *E. Murray 1148* (Ba).

VITEX NEGUNDO var. *INTERMEDIA* (P'ei) Mold.

Additional synonymy: *Vitex negundo* f. *intermedia* (Pei) Mold. ex Venkatareddi, Bull. Bot. Surv. India 11: 258. 1969. *Vitex negundo* var. *intermedia* (P'ie) Mold. ex G. W. Thomas, Tex. Pl. Ecolog. Summ. 78, sphalm. 1969. *Vitex negundo intermedia* [(P'ei) Mold.] ex Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. 6:] 1878. 1970. *Vitex negundo intermedia* (P'ei) Mold., Fifth Summ. 2: 724, in syn. 1971.

Additional bibliography: C. B. Clarke in Hook. f., Fl. Brit. India 4: 584. 1885; Liogier, Rhodora 67: 350. 1965; Mold., Phytologia 17: 17--20. 1968; G. W. Thomas, Tex. Pl. Ecolog. Summ. 78. 1969; Venkatareddi, Bull. Bot. Surv. India 11: 258. 1969; Mold. in Correll & Johnston, Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. 6:] 1340 & 1878. 1970; Viertel, Trees Shrubs Vines no. 406. 1970; Mold., Fifth Summ. 1: 31, 61, 98, 107, 112, 207, 266, 279,

291, 293, 294, 298, 313, 328, 331, & 374 (1971) and 2: 711, 719, 723, 724, & 927. 1971; Mold., Phytologia 23: 414 (1972), 25: 244 (1973), and 28: 446 & 452. 1974; Alain in León & Alain, Fl. Cuba, imp. 2, 2: 318. 1974; Fosberg, Rhodora 78: 113. 1976; Mold., Phytologia 34: 280. 1976; Hsiao, Fl. Taiwan 4: 434. 1978; Mold., Phytol. Mem. 2: 25, 54, 91, 99, 104, 197, 198, 254, 266, 280, 282, 283, 288, 302, 304, 309, 319, 321, 367, 459, & 592. 1980; Mold., Phytologia 48: 489 & 494--500, fig. 1--5. 1981.

Illustrations: Viertel, Trees Shrubs Vines no. 406 [as *V. negundo incisa*]. 1970; Mold., Phytologia 48: 495 & 497--500, fig. 1--5. 1981.

Venkatareddi (1969), citing his *nos. 97634* & *97860,* asserts that this variety "Grows often in association with the typical variety", flowering and fruiting "All the year". Clarke (1885), in his discussion of what he calls "var. *incisa*", comments that "The extreme pinnatifid form of this var. is Chinese; the wild Indian examples are crenate-serrate, i.e. intermediate." It is not clear if he is here referring to var. *intermedia* or, more likely, to var. *cannabifolia* (Sieb. & Zucc.) Hand.-Mazz. The illustration given by Viertel (1970) is labeled "*Vitex negundo incisa*", but plainly depicts, not that variety, but var. *intermedia*.

Recent collectors describe *V. negundo* var. *intermedia* as a spreading deciduous shrub, 1--4 m. tall, with fragrant blossoms. They have found it growing on rocky ground, in dry land on wooded hillsides, along roadsides, "between houses", in mixed woods, and (in Texas) in sandy soil in oak or *Populus-Vitex* communities. They have encountered it at 1000 m. altitude, flowering in May and from July to December. Hu refers to it as "common" in Hong Kong. The Wroten collection, cited below, does not have any statement on its accompanying label that it represents cultivated material, but I am assuming, from the locality of collection, that it does.

The corollas are said to have been "pink" on *Tsang 27843,* "purple" on *Chevalier 12,* and "blue & blue-violet, with a yellow spot in the mouth" on *Cutler 5043*.

Material of this variety has been widely misidentified and distributed in herbaria as *V. agnus-castus* L., typical *V. negundo* L., *V. negundo* var. *cannabifolia* (Sieb. & Zucc.) Hand.-Mazz., and *V. negundo* var. *incisa* (Lam.) C. B. Clarke.

Additional citations: TEXAS: Collingsworth Co.: *L. C. Higgins 6263* (N). Donley Co.: *L. C. Higgins 3910* (N). Harris Co.: *Traverse 1322* (Au--179257). INDIA: East Punjab: *Koelz 8278* (N). Karnataka: *G. Thomson s.n.* [Maisor] (Pd). Uttar Pradesh: *Kapoor & Thamman 27194* (Mu). CHINA: Anhwei: *Chow 7* (Ac). Fukien: *Ging 5388* (Ws), *5956* (Ws). Kiangsu: *Chiao 22343* (Ws). Kwangsi: *Tsang 27843* (Ca--1286197); *Wan & Chow 79016* (Ld). CHINESE COASTAL ISLANDS: Hainan: *Liang 63036* (Mu). HONG KONG: *Hu 6858* (W--2711970), *9243* (W--2711719). JAPAN: Honshu: *Maximowicz s.n.* [Yokohama, 1862] (Pd). TAIWAN: *Oldham 383* (Pd). PHILIPPINE ISLANDS: Luzon: *Rothdauscher s.n.* [Manilla, 1879] (Mu--1523). CULTIVATED: Cayman Islands: *N. Chevalier 12* (N). Cuba: *Cutler 5043* (Ba). Louisiana:

Wroten C.423 (Ne--33949). Oklahoma: *E. M. Alexander 35* (Tu--129545). Pakistan: *Iqbal s.n.* [7-9-1957] (Kh). Virginia: *H. A. Allard 11390* (Se--134450).

VITEX NEGUNDO var. *LAXIPANICULATA* P'ei

Additional bibliography: Mold., Phytologia 8: 67. 1961; Mold., Fifth Summ. 1: 291 (1971) and 2: 927. 1971; Mold., Phytol. Mem. 2: 280 & 592. 1980.

VITEX NEGUNDO var. *MICROPHYLLA* Hand.-Mazz.

Additional bibliography: Mold., Phytologia 15: 311. 1967; Mold., Fifth Summ. 1: 291 (1971) and 2: 927. 1971; Mold., Phytol. Mem. 2: 280 & 592. 1980.

VITEX NEGUNDO var. *PHILIPPINENSIS* Mold., Phytologia 38: 308. 1978.

Synonymy: *Vitex negundo* var. *philippensis* Mold., Biol. Abstr. 65: 6769. 1978.

Bibliography: Mold., Biol. Abstr. 65: 6769. 1978; Mold., Phytologia 38: 308. 1978; Hocking, Excerpt. Bot. A.33: 86. 1979; Mold., Phytol. Mem. 2: 309, 319, 367, 459, & 592. 1980; Mold., Phytologia 48: 490. 1981.

Collectors have found this plant in flower in January, March, May, July, and November and in fruit in March. The *Loher 4433* specimen in the Munich herbarium is a mixture with something non-verbenaceous.

Most of the material cited below was originally distributed and previously cited by me as typical *V. negundo* L.

Citations: PHILIPPINE ISLANDS: Luzon: *Elmer 8125* (N--type); *Loher 4433* in part (Mu--3966, Z); *E. D. Merrill 1503* (N), *1636* (N), *2320* (N), *3429* (N), *Sp. Blanc. 440* (Gg--31493, N); *Rothdauscher s.n.* [Manilla, 1879] (Mu--1522). GREATER SUNDA ISLANDS: Java: *Teijsmann 16728* (N). CULTIVATED: Java: *Herb. Hort. Bogor. XV.J.A.XXXIV.6* (Bz--26411, Bz--26412, Bz, Bz, Bz, Bz, N); *Koorders 42133b* (Bz--24462, Bz--25663, N).

VITEX NEGUNDO f. *PURPURASCENS* Sivarajan & Mold. in Mold., Phytologia 28: 404. 1974.

Bibliography: Mold., Phytologia 28: 404 & 445. 1974; Hocking, Excerpt. Bot. A.25: 379. 1975; Mold., Phytol. Mem. 2: 266, 367, & 592. 1980; Mold., Phytologia 48: 490. 1981.

Collectors describe this plant as a shrub or small tree, the leaves "densely deep purplish tomentose beneath when alive" *(Sivarajan 1327)*, "purplish beneath" *(Fortune 25)*, or with "underside of leaves violet" *(Corner s.n.)*. Corner also describes the "inflorescence and flowers violet, corolla with a white spot in the throat". The leaflets are all 3 per leaf on some sheets of *Fortune 25* and either 3 or 5 on others, in all cases remarkably small in size. Corner reports the vernacular name, "kemuning hitam", in Malaya, and reports that the form is cultivated "elsewhere in Malaya", too.

Citations: INDIA: Kerala: *Shivarajan s.n.* [Calicut] (Ld); *Sivarajan 1327* (Ld, Uc), *CU.1849* (Z--type). HONG KONG: *Fortune 25*

(E--2168600, Mu--650). CULTIVATED: Malaya: *Corner s.n.* [Jan. 1978] (Ld).

VITEX NEGUNDO var. *SESSILIS* Mold.

Additional bibliography: Mold., Phytologia 15: 311. 1967; Mold., Fifth Summ. 1: 374 (1971) and 2: 927. 1971; Mold., Phytol. Mem. 2: 367 & 592. 1980.

VITEX NEGUNDO var. *TRIFOLIOLATA* Mold., Phytologia 25: 432. 1973.

Bibliography: Mold., Biol. Abstr. 56: 3000. 1973; Mold., Phytologia 25: 432. 1973.

Recent collectors refer to this plant as a shrub or small tree "common" in open places especially along streams, the leaves green above and white beneath, and have found it in flower in January and July. The corollas are said to have been "purple" on the Ramamoorthy collection and "blue" on that of Saldanha, cited below.

Material of this variety has in the past been distributed in herbaria as typical *V. negundo* L.

Citations: PAKISTAN: Baluchistan: *K. H. Rechinger 29984* (W--2637733--type). INDIA: Karnataka: *Ramamoorthy HFP.374* (W--2794868); *Saldanha 12470* (W--2794869).

VITEX NEGUNDO var. *VARIEGATA* L. H. & E. Z. Bailey, Hortus Third 1162 [as "Cv. 'Variegata']. 1976; Mold., Phytol. Mem. 2: 459. 1980.

Synonymy:*Vitex negundo* cv. 'Variegata' L. H. & E. Z. Bailey, Hortus Third 1162. 1976.

Unfortunately the Baileys fail to provide a description for this variety, but obviously the name is intended to apply to the form of the species with its leaflets variegated with white or yellow blotches [foliolis albo- vel luteo-variegatis].

VITEX NEO-CALEDONICA Gandoger

Additional bibliography: Mold., Phytologia 15: 311--312. 1967; Mold., Fifth Summ. 1: 343 (19710 and 2: 724, 776, & 927. 1981; Mold., Phytol. Mem. 2: 332 & 592. 1980.

VITEX NLONAKENSIS Engl.

Additional bibliography: Mold., Phytologia 15: 312. 1967; Mold., Fifth Summ. 1: 224 (1971) and 2: 927. 1971: Mold., Phytol. Mem. 2: 215 & 592. 1980.

[to be continued]

NOTES ON NEW AND NOTEWORTHY PLANTS. CXLIX

Harold N. Moldenke

LANTANA GLANDULOSISSIMA f. *PARVIFOLIA* Mold., f. nov.

Haec forma a forma typica speciei laminis foliorum plerumque . 2--4 cm. longis 1.8--2.6 cm. latis recedit.

This form differs from the typical form of the species in having its mature leaf-blades mostly only 2--4 cm. long and 1.8--2.6 cm. wide.

The type of the form was collected by J. Rzedowski (*no. 7933*) in cactus-mesquite matorral 28 km. south of San Luis Potosí, San Luis Potosí, Mexico, along the central road to Mexico City, at 1900 m. altitude, on August 3, 1956, and is deposited in the Herbario Nacional of the Instituto de Biologia in Mexico City.

LANTANA URTICOIDES f. *ACULEATA* Mold., f. nov.

Haec forma a forma typica speciei ramulis argute aculeatis recedit.

This form differs from the typical form of the species in having its stems, branches, and branchlets conspicuously thorny-aculeate.

The type of the form was collected by L. S. Smith and Y. Corona (*Mex.28*) a few km. north of Tehuacán, Puebla, Mexico, at an altitude of about 6000 feet, on August 4, 1966, and is deposited in the Herbario Nacional, Instituto de Biologia, Mexico City.

LANTANA VELUTINA f. *FLAVA* Mold., f. nov.

Haec forma a forma typica speciei corollis flavis recedit.

This form differs from the typical form of the species in having yellow corollas.

The type of the form was collected by Robert Bye (*no. 7753*) at the base of Buenos Aires falls in the short-tree forest on the north side of a barranca on the La Bufa to Quiraro road, Municipality of Batopilas, Chihuahua, Mexico, at 1100 m. altitude, on July 30, 1977, and is deposited in the Herbario Nacional, Instituto de Biologia, Mexico City. The collector describes the plant as a small shrub, about 1 m. tall, with recurved spines on the twigs [not evident on the type specimen], the leaves sticky, and the flowers [corollas] yellow.

VITEX VESTITA f. *UNIFOLIOLATA* Mold., f. nov.

Haec forma a forma typica speciei foliis ut videtur unifoliolatis recedit.

This form differs from the typical form of the species in apparently having its leaves only unifoliolate, the leaflet apparently usually borne at a considerable angle with the petiole.

The type of this form was collected by W. J. J. O. de Wilde and B. E. E. de Wilde-Duyfjes (*no. 13415* in a montane rainforest at Camp. 2, ascent of Gunung Bandahara, Gunung Leuser Nature Reserve, Atjeh, Sumatra, June 27, 1972, deposited in the U.S.National Herbarium, Washington.

BOOK REVIEWS

Alma L. Moldenke

"NEPTUNE'S GIFT - A History of Common Salt" by Robert P. Multhauf, xix & 325 pp., 37 b/w fig., 9 maps, 36 tab, & 99 photo. Johns Hopkins University Press, London & Baltimore, Maryland 21218. 1979 Second printing. $22.50.

Most botanical students, technicians, professors and aficionados are aware of (cell theory fame with Schwann) Schleiden's "Die Rose" 1873, but maybe not about his "Das Salz" 1874 where "we see laid out the evidences of salt in history, literature, commerce, folklore, science and technology". Part I of Multhaus' book covers this earlier Age of Culinary Salt with sources for this universal necessity and primitive methods of production from sea brine and rock salts in various countries. Part II deals with the Era of Chemical Salt with exploitation of mother liquors, salt geology, the Kali and petroleum industry rise, dye and chlorine. Appendix I gives statistics on Salt Production and II on Production of Artificial Soda, Sodium Hydroxide and Chlorinated Hydrocarbons. The illustrations are of great interest historically as is the text for reading. Of course, for many kinds of chemists this is a needed book.

"BIBLE PLANTS AT KEW" by F. Nigel Hepper, 64 pp., 26 color photo., 11 draw., 1 map & 1 fig. Her Majesty's Stationery Office, London EC1P 1BN. 1981. £2.95 net paperbound.

A few decades ago when strolling through the immaculately kept Royal Botanic Gardens at Kew, I noticed how very many plants scattered about were ones that were mentioned in the Bible under one name or another. In this regard it must be remembered that the King James Version (1611) predated Linnaeus' start of binomial nomenclature by a century and a half. The map of these gardens, the descriptive text, the beautifully clear color photographs, all help with identifying Biblical plants.

"WORLD ENERGY: THE FACTS AND THE FUTURE" by Don Hedley, 368 pp., 154 b/w tab., 32 charts. Facts on File, Inc., New York, N. Y. 10019. 1981. $22.50.

The author states "that the most pressing problem [facing mankind now] is to maintain the world's energy supply.....The 'energy crisis' represents a threat to progress and to standards of living in rich and poor countries alike which is inevitable and imminent. Our fuels....will run out" soon. With clearly explanatory and reliable text, effective and clearcut charts and tables the author

"forecasts how the world energy economy will have changed by the year 2000 and what is likely to happen beyond....internationally, nationally, commercially and personally."

"LEWIS AND CLARK'S AMERICA - A Voyage of Discovery" by Willis F. Woods, Director Seattle Art Museum, Bicentennial Illustrated Catalogue, 96 pp., 13 color prints, 76 b/w prints, 3 maps.
"LEWIS AND CLARK'S AMERICA - A Contemporary Photo Essay", photography by Paul Macapia, journal and sketches by Mary E. Macapia. Seattle Art Museum, 96 pp., 58 b/w photos, 5 maps & 4 draw. University of Washington Press, Seattle, Washington 98105. 1976. Both $12.50 paperbound & slip-covered.

These books make a lovely combination; each is attractive in its own right. The paintings of American and European artists made after the expedition are beautiful, accurate and very well printed for the scenery, the wildlife, the Amerinds and some of their artifacts. The small expedition left on May 14, 1804, reached the Pacific coast and returned to St. Louis on September 23, 1806. "Lewis was a born naturalist. He saw and described 178 plants.....117 are present today in the Lewis and Clark Herbarium at the Academy of Natural Sciences in Philadelphia. The vertebrate animals....totaled 122 species and subspecies." Woods' introduction also mentions the artists. Macapia"s beautiful photographs, carefully avoiding Coca Cola signs, Russian thistle growing and airplanes flying, are arranged along the expedition's route as indicated by his wife's journal and sectional maps.

"YOUR BIBLICAL GARDEN - Plants of the Bible and How to Grow Them" by Allan A. Swenson, xxii & 217 pp., 8 color pl., 24 b/w photo. pl. & 25 draw. Doubleday & Co., Garden City, New York, or New York, New York 10017. 1981. $13.95.

"Many of the most beautiful, more striking plants of the scriptures are available to you for your outdoor home gardens or for growing indoors as house plants and in containers on porch, balcony or rooftop in the city. Here, for easy reference, are the names of the plants that you will find in this book, the fruits and flowers, herbs, vegetables and trees." Alternate choices, similar species or forms, growing directions and items of special interest comprise the easily read text which is enriched by excellent photographic prints. The drawings, like that of the pomegranate, offer little embellishment.

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